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RAILWAY
MECHANICAL ENGINEER

Rock Island Suburban Diesels

Two 1,500-hp. locomotives are modifications of the builder's all-purpose locomotive with 85 m. p. h. gearing, electro-pneumatic brakes, tight-lock couplers, head-end lighting generator and dual cab controls

THE first regularly scheduled Diesel suburban service in the Chicago area was inaugurated January 6 by the Chicago, Rock Island & Pacific between Chicago and Joliet, Ill., with the assignment of two 1,500-hp. suburban locomotives built by Fairbanks, Morse & Co. The use of Diesel power on some, and perhaps eventually on all, suburban trains is part of the road's plans for a complete rehabilitation of this service, including 20 new streamlined coaches and the remodeling of existing rolling stock. The locomotives are assigned to service between both Chicago and Joliet, Ill., and between Chicago and Blue Island, Ill., distances of 40.2 and 15.7 miles, respectively.

To get maximum mileage from the locomotives, a careful assignment was made for each such that it completed a week-day cycle once in two days. As shown in the graphs for the Monday-to-Friday schedules, locomotive No. 1 leaves Blue Island just before five o'clock Monday morning and between that time and approximately 12:40 a.m. Tuesday morning makes two-and-one-half round trips between Blue Island and Chicago and two-and-one-half round trips between Chicago and Joliet, tying up at Joliet. Locomotive No. 2 leaves Joliet on Monday morning at about 7:35 a.m. and between that time and about 12:40 a.m. Tuesday, makes three-and-one-half round trips between Joliet and Chicago and one-and-one-half round trips between Chicago and Blue Island, tying up at Blue Island. On Tuesday, locomotive No. 2 makes the Monday schedule of locomotive No. 1 and locomotive No. 1 makes the Monday schedule of locomotive No. 2.

This continues alternately until Saturday when each locomotive makes two-and-one-half round trips each between Blue Island and Chicago and Joliet and Chicago, locomotive No. 1 starting from Joliet and locomotive No. 2 from Blue Island. On Sunday, each locomotive makes two round trips between each of the two sets of terminal points, locomotive No. 1 starting from Blue Island and terminating at Blue Island and locomotive No. 2 starting at Joliet and terminating at Joliet. Thus, each locomotive performs a complete cycle during the week and starts from the same point each Monday morning.

The weekly mileage for locomotive No. 1 is 1,998.6 and for locomotive No. 2, 2,047.6, a daily average of 285.5 miles and 292.5 miles, respectively. As shown on the diagrams, layovers between runs during the day are relatively short. The night layovers at Blue Island between week-day schedules are approximately 4¼ hours long; those at Joliet are just short of 7 hours. On Saturdays

Table I—Partial List of Materials and Equipment on the Rock Island Suburban Locomotives

Main generator; traction motors; auxiliary generator; radiator fan motor; exciter; traction motor blower motors; fan generator; electrical control equipment; load control equipment; start, stop, high- and low-power switches	Westinghouse Electric Corporation, Pittsburgh, Pa.
Air-brake equipment (Electro-pneumatic high-speed 2426*); control throttle and associated equipment (two control stands furnished for operation in either direction*); multiple-unit control equipment*; electric speedometer*; locomotive overspeed control equipment*; air compressor; M. G. set for isolating air-brake circuits*; signal horns	Westinghouse Air Brake Company, Wilmerding, Pa.
Engine governor	Woodward Governor Company, Rockford, Ill.
12 kw., 64-volt, d.c. generator for head-end lighting of existing suburban equipment	Fairbanks, More & Co., Chicago
Alarm bell	Graybar Electric Company, New York
Alarm buzzer	Electric Service Mfg. Co., Philadelphia, Pa.
Jumper cables and receptacles*; headlights; marker lights	Pyle-National Company, Chicago
Heating boiler and associated equipment	Vapor Heating Corporation, Chicago
Tight lock coupler, Type H*	National Malleable & Steel Castings Co., Cleveland, Ohio
Cab signal and control equipment Type E*	Union Switch & Signal Co., Swissvale, Pa.
Control equipment for passenger-car lighting generator*	Safety Car Heating & Lighting Co., New York
Hydrostatic fuel gage*	Manning, Maxwell & Moore, Bridgeport, Conn.
Sanders	Morris B. Brewster Company, Chicago
Hand brake	National Brake Company, New York
Batteries	Gould Storage Battery Company, Depew, N. Y.
Signal bell and clapper	Howard Foundry Company, Chicago
Footboards and steps	Blaw-Knox Company, Pittsburgh, Pa.
Window wipers	C. A. Sprague Devices, Michigan City, Ind.
Sun visors	Fulton Company, Milwaukee, Wis.
Cab heater; radiator shutters	Kysor Heater Company, Cadillac, Mich.
Fire extinguishers	C-O-Two Fire Equipment Co., Newark, N. J.
Draft gear	National Malleable & Steel Castings Co., Cleveland, Ohio
Truck frame	General Steel Castings Corporation, Eddystone, Pa.
Springs	American Steel Foundries, Chicago
Brake rigging	Westinghouse Air Brake Company, Wilmerding, Pa.
Brake shoes	American Brake Shoe Company, New York
Wheels	Edgewater Steel Company, Pittsburgh, Pa.
Journal bearings	Timken Roller Bearing Company, Canton, Ohio
Cab seats	Coach & Car Equipment Co., Chicago
Cab insulation	Johns-Manville, New York
Radiators	Yates-American Machine Company, Beloit, Wis.
Radiator fan	Jeffrey Mfg. Co., Columbus, Ohio
Flexible coupling	Falk Corporation, Milwaukee, Wis.
Auxiliary fuel-oil pump	Geo. D. Roper Corporation, Rockford, Ill.
Doors	Morton Mfg. Co., Chicago
Exhaust snubber assembly	Burgess-Manning Company, Libertyville, Ill.
Lube oil filter	Michiana Products Corporation, Michigan City, Ind.
Lube oil cooler	Ross Heater & Mfg. Co., Buffalo, N. Y.
Air intake filter, engine	Farr Company, Los Angeles, Calif.
Temperature regulator	Fulton Sylphon Company, Knoxville, Tenn.

*Not standard on 1,500-hp. all-purpose locomotive

and Sunday nights layovers vary somewhat because of the difference in schedules on those days.

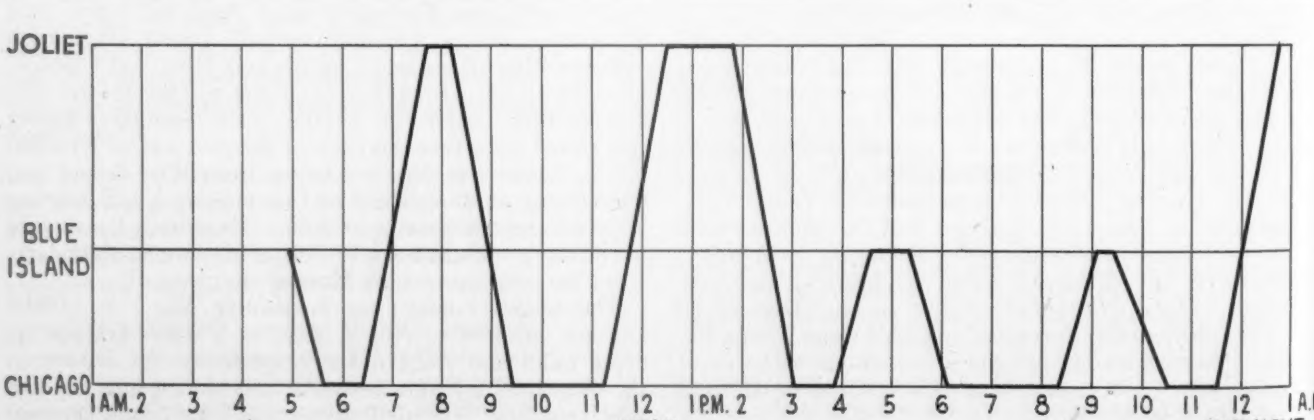
The basic design of the suburban locomotive is a modification of the Fairbanks-Morse 1,500-hp. all-purpose locomotive. It has the standard Fairbanks-Morse opposed-piston engine of the same design used in that company's 1,000-hp. switchers, 1,500-hp. all-purpose locomotives and 2,000-hp. road locomotives.

The four traction motors and the main generator were supplied by Westinghouse Electric Corporation. The former are series-wound, force-ventilated type 370-F. The main generator is the type 472-A self-ventilated model with the armature connected directly to the crankshaft through a flexible coupling. It is separately excited from an exciter mounted on the main generator and driven by a V-belt from a shaft extension of the generator. Power for battery charging, controls and lighting is furnished by an auxiliary generator mounted on the main generator and driven by V-belts. A fan generator mounted on the main generator shaft provides power for a radiator fan motor and the two traction motor blowers.

A number of modifications and additions were made to the all-purpose locomotive to convert it into the suburban design. The two suburban locomotives have a 60:19 gear ratio for a maximum speed of 85 m.p.h. Dual cab controls are installed on the locomotive with the additional station located on the opposite side of the cab from the standard control station. The features incorporated at the second station are Throttle, Reverser, Sander valve, Bell ringer valve, Independent and automatic brake valve, All air brake gauges, Wheel slip indicator, Speedometer, Load ammeter, Cab-light switch, Auxiliary fuel pump switch, Locomotive run switch, Engine start and stop switches, High and low power switches, Switch for front

Table II—Principal Weights and Dimensions of the Rock Island 1,500-hp. Suburban Locomotives

Type	0-4-4-0 (B-B)
Principal Dimensions:	
Overall length (inside knuckles), ft.—in.	54-0
Overall width, ft.—in.	10-4
Width of power plant compartment, ft.—in.	6-0
Width over radiator compartment, ft.—in.	7-0
Overall height above rail, ft.—in.	14-6
Wheelbase each truck, ft.—in.	9-6
Wheelbase total locomotive, ft.—in.	39-6
Distance between truck centers, ft.—in.	30-0
Weights; lb.:	
Total locomotive in working order (without boiler)	240,000
On drivers	240,000
Weight per axle	60,000
Transmission:	
Driving motors	4
Driving wheels, pairs	4
Diameter wheels, in.	42
Starting tractive force (at 30 per cent adhesion), lb.	72,000
Minimum radius curvature (locomotive alone), ft.	150
Supplies:	
Fuel oil, gal.	900
Lubricating oil, gal.	300
Engine cooling water, gal.	175
Sand, cu. ft.	28
Boiler water, gal.	1,000



Schedule of locomotive No. 1 on Mondays, Wednesdays and Fridays and of locomotive No. 2 on Tuesdays and Thursdays

Table III—Saturday and Sunday Assignments of Rock Island Suburban Diesels

LOCOMOTIVE No. 1 (SATURDAY)

Leave		Arrive		Distance-Miles
Blue Is.	5:05 a.m.	Chicago	5:50 a.m.	15.7
Chicago	6:25 a.m.	Joliet	7:42 a.m.	40.2
Joliet	8:10 a.m.	Chicago	9:25 a.m.	40.2
Chicago	11:15 a.m.	Joliet	12:30 p.m.	40.2
Joliet	1:50 p.m.	Chicago	3:02 p.m.	40.2
Chicago	3:50 p.m.	Blue Is.	4:35 p.m.	15.7
Blue Is.	6:00 p.m.	Chicago	6:50 p.m.	15.7
Chicago	7:25 p.m.	Blue Is.	8:10 p.m.	15.7
Blue Is.	9:25 p.m.	Chicago	10:10 p.m.	15.7
Chicago	11:30 p.m.	Joliet	12:42 a.m.	40.2
		TOTAL DAILY MILEAGE		279.5

LOCOMOTIVE No. 2 (SATURDAY)

Leave		Arrive		Distance-Miles
Joliet	7:37 a.m.	Chicago	8:30 a.m.	40.2
Chicago	9:20 a.m.	Blue Is.	10:05 a.m.	15.7
Blue Is.	10:55 a.m.	Chicago	11:40 a.m.	15.7
Chicago	1:05 p.m.	Joliet	2:23 p.m.	40.2
Joliet	3:20 p.m.	Chicago	4:40 p.m.	40.2
Chicago	5:11 p.m.	Blue Is.	5:59 p.m.	15.7
Blue Is.	7:00 p.m.	Chicago	7:50 p.m.	15.7
Chicago	8:30 p.m.	Joliet	9:45 p.m.	40.2
Joliet	10:30 p.m.	Chicago	11:35 p.m.	40.2
Chicago	11:55 p.m.	Blue Is.	12:40 a.m.	15.7
		TOTAL DAILY MILEAGE		279.5

LOCOMOTIVE No. 1 (SUNDAY)

Leave		Arrive		Distance-Miles
Blue Is.	5:55 a.m.	Chicago	6:41 a.m.	15.7
Chicago	7:05 a.m.	Joliet	8:22 a.m.	40.2
Joliet	9:45 a.m.	Chicago	11:00 a.m.	40.2
Chicago	12:05 p.m.	Blue Is.	12:50 p.m.	15.7
Blue Is.	4:05 p.m.	Chicago	4:50 p.m.	15.7
Chicago	5:50 p.m.	Joliet	7:02 p.m.	40.2
Joliet	8:15 p.m.	Chicago	9:20 p.m.	40.2
Chicago	10:38 p.m.	Blue Is.	11:23 p.m.	15.7
		TOTAL DAILY MILEAGE		223.6

LOCOMOTIVE No. 2 (SUNDAY)

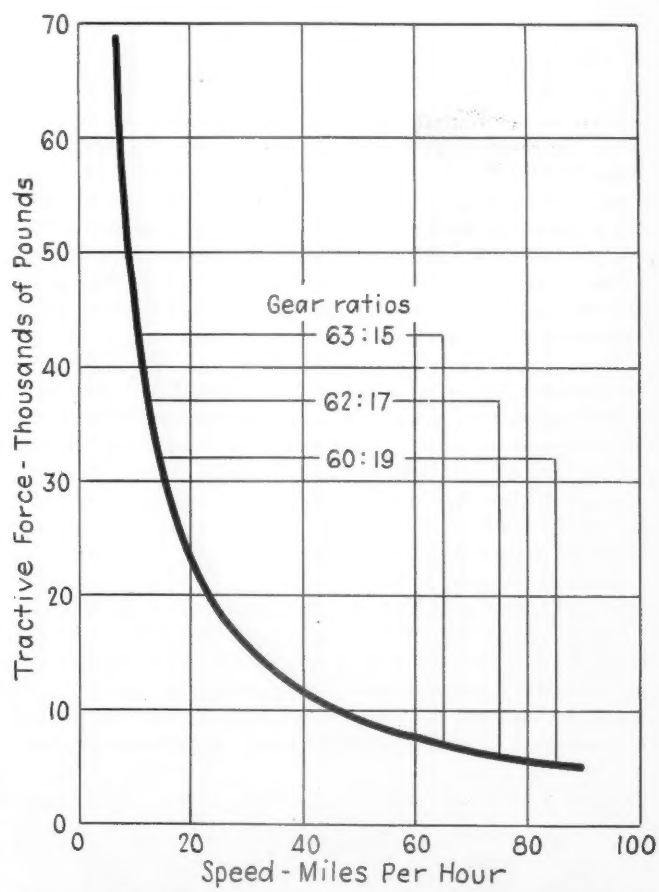
Leave		Arrive		Distance-Miles
Joliet	6:15 a.m.	Chicago	7:31 a.m.	40.2
Chicago	8:20 a.m.	Blue Is.	9:05 a.m.	15.7
Blue Is.	9:42 a.m.	Chicago	10:27 a.m.	15.7
Chicago	1:05 p.m.	Joliet	2:23 p.m.	40.2
Joliet	4:00 p.m.	Chicago	5:05 p.m.	40.2
Chicago	5:45 p.m.	Blue Is.	6:41 p.m.	15.7
Blue Is.	8:25 p.m.	Chicago	9:15 p.m.	15.7
Chicago	11:30 p.m.	Joliet	12:42 a.m.	40.2
		TOTAL DAILY MILEAGE		223.6

and rear headlights, Number box lights switch, No. 2 end of unit and Transfer switch for nullifying headlight and locomotive run circuits at the standard control station.

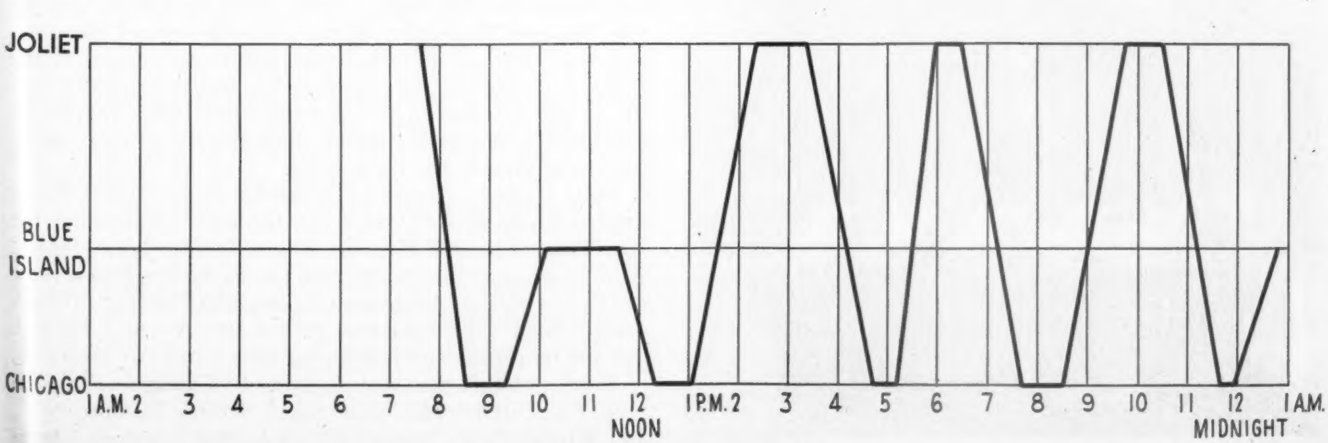
Multiple-unit control is installed and provides for multiple operation in any combination. The locomotives have A.A.R. Type H tight-lock couplers with National Malleable rubber draft gear. H.S.C. electro-pneumatic braking is provided as a modification to the standard brake equipment. Each locomotive has an overspeed control to limit maximum speed for protection of the traction motor armatures.

The locomotives are equipped with a Vapor Heating Corporation 1,600-lb. steam generator with remote controls and all necessary equipment for multiple operation of the boiler equipment when two units are used in multiple service. The boiler water capacity is 1,000 gal.

Other items of equipment on the suburban locomotive include a 750-watt, 64-volt, motor-generator set for operating the air brake circuit, cab signal control equipment with receivers at both ends to pick up cab signal indications for either direction of operation, two electric speedometers, a 12-kw., 70-to-85-volt head-end lighting installation with necessary jumpers and accessories for furnishing train electric power in either single- or double-unit service, a Pyle National terminal lighting receptacle to permit lighting from 110-volt terminal power, a hydrostatic distant-type fuel level gauge in the cab, four pneumatic double windshield wiper blades, Timken Journal roller bearing heat indicators, and Protectoseal fuel filler and water filler connections.

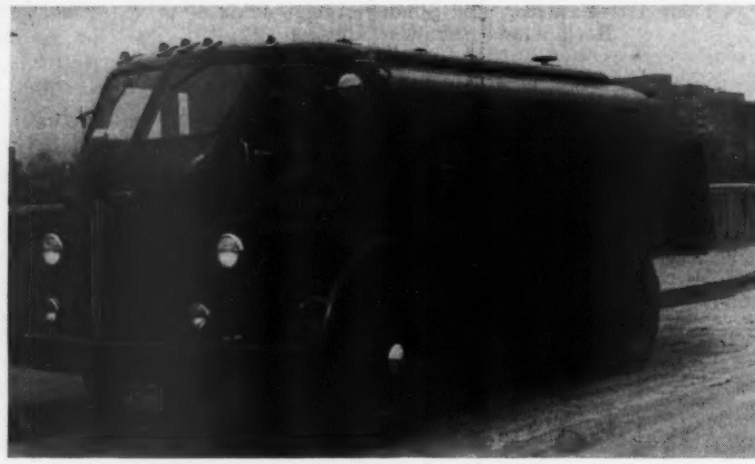


The speed-tractive-force curve for the 1,500-hp. Rock Island suburban locomotive



Schedule of locomotive No. 2 on Mondays, Wednesdays and Fridays and of locomotive No. 1 on Tuesdays and Thursdays

Refueling Diesels at Work

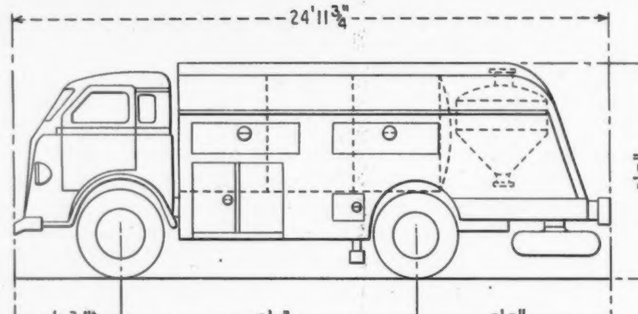


A SYSTEM of refueling and resanding Diesel switching locomotives without requiring them to be brought into engine terminals or other fixed-location service stations has been developed by the Pennsylvania. This comprises a fleet of 16 engine-under-the-seat Autocar trucks, on which are installed fuel-oil and sand tanks and dispensing facilities, which are dispatched from central points to the outlying locations where locomotives are working. Servicing proceeds at the rate of 50 gal. of fuel oil and 100 lb. of sand per min. A complete refueling takes about 10 min.

As an example of the possibilities, consider a switching locomotive working out of Frankford Junction, Philadelphia, Pa., which may be engaged at Red Lion, ten miles away. This locomotive has a capacity of 600 gal. of fuel oil and burns 150 gal. in 24 hours. In three days, starting with a full tank, there will be about 150 gal. of fuel left and it will be time to refuel. It is estimated that it would take three hours for the locomotive to make the round trip to Frankford Junction for servicing and this would have to be repeated every three days.

Plans to develop railside service of Diesel switching locomotives were begun by Pennsylvania engineers in the fall of 1947. Investigation showed that the model U-70 Autocar, with its engine under the seat, best meets the requirements of maneuverability and weight distribution.

The pneumatic sand dispensing equipment



The fuel tank is behind the cab and the sand hopper at the rear

The truck, which has a gross weight rating of 30,000 lb., has a comparatively short wheel base of 145 in., thus providing for a high degree of maneuverability along the right-of-way and in the yards. Because the front axle carries an unusually large share of the load, the Autocar can carry more than ordinary loads without exceeding rear-axle weight limits imposed by various states.

The truck is equipped with a 1,500-gal. oil tank which is divided into three compartments and is carried at the forward end of the chassis. The tanks were built by the Rebmann Company, tank manufacturers at Philadelphia. Oil is pumped from the tank by a power take-off from the Autocar engine, using equipment similar to that employed on household oil delivery trucks. There are also cabinets for lubricants.

The sand hopper has a capacity of one ton and is placed back of the oil tank. These were also built by the manufacturer of the oil tanks. The sanding problem was to transfer the sand from the hopper to the sand box on the locomotive through a hose. Sand is fed by gravity into the conical hopper, which is a pressurized chamber, and is blown into the discharge line by an air jet at the point of discharge. An air dryer has been introduced into the intake air line to prevent moisture being carried to the sand. Compressed air is obtained by connection to the brake pipe of the locomotive.

Fully loaded, these service trucks carry 10,000 lb. on the front axle and 19,996 lb. on the rear—just under the 20,000-lb. rear-axle limit in Pennsylvania, New Jersey, New York, and Illinois. On the trucks assigned to service in Ohio a bulkhead has been inserted in the rear oil-tank compartment which reduces the oil capacity to 1,230 gal. and the rear-axle load below that state's limit of 18,000 lb.

Trucks of this fleet are assigned to Chicago; Philadelphia, Pa., Pittsburgh, Pitcairn and Scully; Buffalo, N.Y., and Morris Park; Jersey City, N.J., and Trenton; Cleveland, Ohio, Mingo Junction, Youngstown, and Columbus.

Locomotive Inspection Report

Inspections of locomotives other than steam increase by more than 50 per cent due to increasing number in service. Steam locomotive boiler explosions cause of 11 deaths

THE thirty-seventh annual report of the Bureau of Locomotive Inspection, Interstate Commerce Commission, for the fiscal year ending June 30, 1948, recently issued by John M. Hall, director, continues to show a decrease in the number of steam locomotives inspected while at the same time an increase in the number of inspections of "locomotives other than steam" of more than 50 per cent. The total number of inspections was 114,715 of all types of locomotives as compared with 107,149 during the previous fiscal year. The percentage of steam locomotives inspected and found defective was 10 as compared with 11 for the previous two years and the percentage of locomotives other than steam was 4.1 as compared with 4.8 the previous year. The total number of steam locomotives ordered out of service was 654 out of a total of 93,917 inspected as compared with a total of 21 locomotives "other than steam" ordered out of service out of a total of 20,798 inspected. Boiler explosions accounted for a total of 14 deaths, an increase of two from the previous year.

Table I—The Number of Locomotives in Service, the Number Inspected and the Conditions Found

STEAM LOCOMOTIVES

	Year ended June 30—				
	1948	1947	1946	1945	1944
Number of locomotives for which reports were filed	37,073	39,578	41,851	43,019	43,297
Number inspected	93,917	94,034	101,869	115,979	117,334
Number found defective	9,417	10,248	11,337	11,975	12,710
Percentage inspected found defective	10	11	11	10	11
Number ordered out of service	654	708	690	506	630
Number of defects found	38,855	41,250	56,541	53,367	56,617

LOCOMOTIVES OTHER THAN STEAM

	Year ended June 30—				
	1948	1947	1946	1945	1944
Number of locomotive units for which reports were filed	9,803	7,805	6,616	6,094	5,139
Number inspected	20,798	13,115	10,908	9,888	7,711
Number found defective	853	633	499	447	378
Percentage of inspected found defective	4.1	4.8	4.6	4.5	4.9
Number ordered out of service	21	19	17	16	9
Number of defects found	1,745	1,442	1,385	1,212	1,026

Table II — Accidents Caused by the Failure of Locomotive Parts and Appurtenances

STEAM LOCOMOTIVES INCLUDING BOILER AND TENDER

	Year ended June 30—				
	1948	1947	1946	1945	1944
Number of accidents	341	360	419	410	403
Percent increase or decrease from previous year	5.3	14.1	[1]2.2	[1]1.7	[1]26.3
Number of persons killed	15	16	10	20	25
Percent increase or decrease from previous year	6.3	[1]60.0	50.0	20.0	7.4
Number of persons injured	361	464	439	429	466
Percent increase or decrease from previous year	22.2	[1]5.7	[1]2.3	7.9	[1]24.9

STEAM LOCOMOTIVE BOILER[2]

	Year ended June 30—					
	1948	1947	1946	1945	1944	1943
Number of accidents	104	116	156	141	141	129
Number of persons killed	14	12	10	13	17	25
Number of persons injured	108	124	165	154	194	173

LOCOMOTIVES OTHER THAN STEAM

	Year ended June 30—				
	1948	1947	1946	1945	1944
Number of accidents	41	40	38	29	17
Number of persons killed	....	2	....	1	....
Number of persons injured	50	41	56	40	23

[1]Increase.
[2]The original act applied only to the locomotive boiler.

Explosions and Other Boiler Accidents

Thirteen boiler explosions occurred in the fiscal years; all were caused by overheating of the crown sheets due to low water. Twelve employees were killed in these accidents and 15 were injured. There was a reduction of 1 in the number of boiler explosions, an increase of 1 in the number of employees killed, and a reduction of 7 in the number of employees injured compared with the preceding year.

One of the explosions occurred on a locomotive in passenger-train service, one on a locomotive in mixed-train service, nine on locomotives in freight-train service, and two on locomotives in charge of engine watchmen. Investigations developed that absence of safe water level was known by employees on six of the locomotives in advance of the occurrence of the explosions.

The locomotive in passenger-train service, upon which one employee was injured, and three of the locomotives in freight train service upon which three employees were killed and three injured were equipped with low-water alarms which gave warnings of impending low water but sufficiently prompt and appropriate action to restore the water level or to extinguish the fires was not taken in any instance.

Water was known to be low prior to explosions of two other boilers of locomotives engaged in freight-train service. These explosions killed one and injured four employees. In one of these instances the fireman was preparing to dump the fire but was stopped by the engineman who said "No, the officials are checking this train tonight and we don't want to delay this important train." In the other instance the train was stopped because of low water and the fireman was preparing to knock the fire.

Anxiety to keep trains moving at the desired speed or to avoid stalling is obviously a principal factor leading to the occurrence of boiler explosions. Reduction in accidents that are brought about by the influence of this factor, and other accidents in which this factor is apparently involved but where the evidence is less conclusive than in the instances cited, can no doubt be accomplished by continuous and persistent effort on the part of officers and supervisors to discourage attempts to maintain the desired schedule under conditions where the water level may not be visible in the water glass, or, in other words, to continually caution all concerned that the well-known rudimentary safety provision "In case of doubt the safe course shall be taken" be invariably followed.

Table III—Accidents and Casualties Resulting From Failure of Locomotive Parts

STEAM LOCOMOTIVES AND TENDERS, AND THEIR APPURTENANCES

Year ended June 30

Part or appurtenance which caused accident	1948			1947			1946			1945			1944		
	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured
Air reservoirs	1		2	1		1	1		1	1		1	3		4
Aprons	5		5	4		4	2		2	8		8	7		7
Arch tubes													1		2
Ashpan blowers							1		1	2	1	1			
Axles	3		3	1	2	1	1		1	2		5	5	1	5
Blow-off cocks	5		5	8		8	15		16	7		7	8		8
Boiler checks	7	1	6	7		7	8		8	6		6	9		9
Boiler explosions:															
A. Shell explosions															
B. Crown sheet; low water; no contributory causes found	10	12	8	11	7	16	15	7	20	7	9	11	12	7	19
C. Crown sheet; low water; contributory causes or defects found	3		7	2	4	3	3	3	2	1		1	7	5	43
D. Miscellaneous firebox failures				2		4	1		1	1		1			
Brakes and brake rigging	11		24	8		12	10		12	10		10	12		12
Couplers	4		4	6		6	5		5	5		6	6		9
Crank pins, collars, etc	2		2	3		3	5		5	5	1	4	7		9
Crossheads and guides	1		1	2		2	3		5	2		2	8		8
Cylinder cocks and rigging	3		3	3		3	1		1	1		1	3		3
Cylinder heads and steam chests	1		1	2		2	1		1	2		3	1		1
Dome caps															
Draft appliances							2		2	2		3	2		3
Draw gear				1		1	1		1	2		2	1		1
Fire doors, levers, etc	10		10	2		2	2		2	8		8	6		6
Flues	8		9	4		4	10		12	5		6	8		9
Flue pockets															
Footboards	15		15	15		15	12		12	13	1	12	6		6
Gage cocks										1		1			
Grease cups				1		1	1		1	1		1	1		1
Grate shakers	15		15	20		20	25		25	17		17	19		19
Handholds	12		12	18		18	20		20	26	1	25	14		14
Headlights and brackets	3		3	2		2	2		2	7		7			
Injectors and connections (not including injector steam pipes)	10		10	14		14	14		14	12		12	8		8
Injector steam pipes	4		5	4	1	4	2		2	1		1			
Lubricators and connections	2		2	4		4	5		5	4		4	5		5
Lubricator glasses							2		2	1		1	1		1
Patch bolts															
Pistons and piston rods	2		2	1		1				2	1	1	3		3
Plugs, arch tube and washout	3		3	1		1	1		1	5	2	6	6	3	7
Plugs in firebox sheets							1		1				1		1
Reversing gear	12		12	13		13	11		11	13		13	16		16
Rivets										1		1			
Rods, main and side	5		7	3	1	2	7		7	7		11	7	2	9
Safety valves															
Sanders	4		4	5		5	4		4	8		8	12		12
Side bearings															
Springs and spring rigging	4		4	3		77	6		7	5	1	4	6	2	8
Squirt hose	5		5	19		19	14		15	23		25	21		22
Staybolts	4		4	2		2	1		1	4		4	4	1	4
Steam piping and blowers	13	1	13	4		4	15		15	12		14	11		14
Steam valves	6		6	8		8	13		13	7		7	7		7
Studs				2		2	1		1	1		1			
Superheater tubes	2		3	2		2	2		2	4		6	2		2
Throttle glands	1		1				1		1	2		2	2		2
Throttle leaking	1		1	2		2	1		1	2		3	1		1
Throttle rigging	10		10	16		17	15		16	6		6	9		9
Trucks, leading, trailing, or tender				2		20	10		12	5		5	5	1	5
Valve gear, eccentrics, and rods	3		3	4		4	7		7	7		7	10	1	9
Water glasses	4		4	8		8	12		13	10		10	14	1	13
Water-glass fittings	3		3	3		3	2		2	1		1	2		3
Wheels	3	1	2				1		1	1		1	1		1
Miscellaneous	121		122	117	1	117	124		127	124	3	126	103	1	106
Total	341	15	361	360	16	464	419	10	439	410	20	429	403	25	466

Table IV—Number of Steam Locomotives Reported Inspected, Found Defective and Ordered Out of Service—Continued

Year ended June 30

Parts defective, inoperative or missing, or in violation of rules	1948	1947	1946	1945	1944	1943
37. Mud rings	186	217	238	257	301	256
38. Packing nuts	456	575	691	654	746	669
39. Packing, piston rod and valve stem	658	691	776	845	879	724
40. Pilots and pilot beams	132	156	153	171	193	194
41. Plugs and studs	169	236	262	245	281	259
42. Reversing gear	649	528	482	439	454	452
43. Rods, main and side, crank pins, and collars	1,998	2,136	2,581	2,569	3,230	2,798
44. Safety valves	45	70	72	84	77	74
45. Sanders	597	569	784	658	609	642
46. Springs and spring rigging	4,124	4,622	5,195	4,734	4,625	3,583
47. Squirt hose	93	79	120	98	94	92
48. Stay bolts	292	318	360	351	400	367
49. Stay bolts, broken	258	283	268	308	232	247
50. Steam pipes	435	356	551	416	435	414
51. Steam valves	150	146	203	157	161	159
52. Steps	767	778	914	681	872	729
53. Tanks and tank valves	1,757	1,558	1,570	1,215	1,400	1,321
54. Telltale holes	60	69	60	78	69	78
55. Throttle and throttle rigging	923	1,026	979	948	948	887
56. Trucks, engine and trailing	812	1,005	1,261	1,151	1,155	1,020
57. Trucks, tender	652	795	1,101	974	928	900
58. Valve motion	676	778	1,080	991	1,021	998
59. Washout plugs	384	441	740	820	845	685
60. Stokers	270	208				
61. Water glasses, fittings, and shields	1,039	1,318	1,190	1,328	1,323	1,454
62. Wheels	779	583	840	899	759	728
63. Miscellaneous—Signal appliances, badge plates, brakes (hand)	707	870	1,337	1,213	1,172	1,151
Total number of defects	38,855	41,250	56,541	53,367	56,617	51,350
Locomotives reported	37,073	39,578	41,851	43,019	43,297	43,064
Locomotives inspected	93,917	94,034	101,869	115,979	117,334	116,647
Locomotives defective	9,417	10,248	11,337	11,975	12,710	11,901
Percentage of inspected found defective	10	11	11	10	11	10
Locomotives ordered out of service	654	708	690	506	630	487

Table V—Number of Locomotives, Other Than Steam, Reported, Inspected, Found Defective, and Ordered Out of Service

Year ended June 30

Parts defective, inoperative or missing, or in violation of rules	1948	1947	1946	1945	1944	1943
Air compressors	32	9	15	14	7	7
Axles, truck and driving	3	2				6
Batteries	8	1	2		1	2
Boilers	30	5	11	8		1
Brake equipment	204	178	102	114	85	62
Cabs and cab windows	90	97	46	59	40	33
Cab cards	37	29	24	25	21	17
Cab floors, aprons, and deck plates	134	130	72	60	54	31
Clutches			2	2	1	2
Controllers, relays, circuit breakers, magnet valves, and switch groups	24	14	16	18	14	9
Coupling and uncoupling devices	12	13	6	6	3	1
Current collecting apparatus	11	3	9	10		1
Draft gear	36	30	18	14	14	15
Draw gear	8	4	3	8		2
Driving boxes, shoes, and wedges	16	38	44	29	12	25
Frames or frame braces	2	7	10	12	12	7
Fuel system	136	66	57	45	33	32
Gages or fittings, air	11	10	7	7	6	3
Gages or fittings, steam	2	5			2	1
Gears and pinions	9	1			1	4
Handholds	32	22	18	13	6	19
Inspections and tests not made as required	59	78	357	297	278	223
Insulation and safety devices	10	11	12	17	8	4
Internal-combustion engine defects, parts and appurtenances	241	254	145	133	86	50

Table III—Accidents and Casualties Resulting from Failure of Locomotive Parts—Continued

LOCOMOTIVES OTHER THAN STEAM, AND THEIR APPURTENANCES

Part or appurtenance which caused accident	1948 Accidents	1948 Killed	1948 Injured	1947 Accidents	1947 Killed	1947 Injured	1946 Accidents	1946 Killed	1946 Injured	1945 Accidents	1945 Killed	1945 Injured	1944 Accidents	1944 Killed	1944 Injured
Brakes and brake rigging	3	......	6	2	......	2	2	......	3	3	......	8	1	......	3
Carburetors	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Couplers	......	......	......	2	......	2	......	......	......	1	......	4	3	......	3
Crankpins and connecting rods	......	......	......	......	......	......	......	......	......	2	......	2	......	......	......
Fires: due to overflowing or leakage of fuel, crankcase explosions, back firing, etc.	3	......	3	7	......	8	4	......	5	6	......	6	4	......	5
Generators and starting devices	1	......	1	......	......	......	......	......	......	......	......	......	......	......	......
Insulation	......	......	......	4	1	5	1	......	1	1	......	1	......	......	......
Pantographs and trolleys	......	......	......	1	1	......	2	......	2	2	1	1	......	......	......
Short circuits	7	......	7	2	......	2	2	......	2	2	......	2	1	......	1
Miscellaneous	27	......	33	22	......	22	27	......	43	12	......	16	8	......	11
Total	41	......	50	40	2	41	38	......	56	29	1	40	17	......	23

Table IV—Number of Steam Locomotives Reported, Inspected, Found Defective, and Ordered Out of Service

Parts defective, inoperative or missing, or in violation of rules	1948	1947	1946	1945	1944	1943
1. Air compressors	1,007	944	1,044	1,054	1,146	968
2. Arch tubes	15	19	27	17	45	50
3. Ashpans and mechanism	72	87	93	81	93	71
4. Axles	8	6	7	11	15	15
5. Blow-off cocks	274	308	388	361	289	291
6. Boiler checks	424	428	526	511	533	503
7. Boiler shell	298	342	462	416	406	377
8. Brake equipment	2,617	2,512	2,992	2,755	2,914	2,661
9. Cabs, cab windows, and curtains	1,049	1,347	1,501	1,057	1,169	1,102
10. Cab aprons and decks	414	428	469	426	381	390
11. Cab cards	109	91	120	91	104	142
12. Coupling and uncoupling devices	55	58	46	57	65	66
13. Crossheads, guides, pistons and piston rods	1,611	1,683	1,941	2,079	2,149	1,961
14. Crown bolts	78	98	88	90	105	66
15. Cylinders, saddles, and steam chests	1,617	2,004	2,217	1,801	2,133	1,395
16. Cylinder cocks and rigging	494	650	679	454	624	430
17. Domes and dome caps	142	130	164	187	189	196
18. Draft gear	461	449	536	486	576	599
19. Draw gear	413	453	462	447	515	469
20. Driving boxes, shoes, wedges, pedestals, and braces	1,582	1,580	1,922	1,803	2,026	2,058
21. Firebox sheets	302	257	333	319	347	303
22. Flues	201	197	253	260	274	215
23. Frames, tail pieces, and braces, locomotive	576	820	1,003	852	1,019	894
24. Frames, tender	72	63	88	97	126	86
25. Gages and gage fittings, air	185	135	185	151	158	191
26. Gages and gage fittings, steam	354	358	370	353	328	316
27. Gage cocks	474	404	495	449	532	584
28. Grate shakers and fire doors	455	444	555	558	539	492
29. Handholds	513	469	540	527	464	483
30. Injectors, inoperative	66	39	50	41	46	66
31. Injectors and connections	2,329	2,369	2,750	2,553	2,867	2,637
32. Inspections and tests not made as required	148	350	8,885	9,067	9,565	9,037
33. Lateral motion	821	791	862	977	898	700
34. Lights, cab and classification	132	155	161	167	243	184
35. Lights, headlight	183	143	168	222	268	184
36. Lubricators and shields	236	228	351	306	257	292

(Continued on page 120)

Table V—Number of Locomotives, Other Than Steam, Reported, Inspected, Found Defective, and Ordered Out of Service—Continued

Parts defective, inoperative or missing, or in violation of rules	1948	1947	1946	1945	1944	1943
Jack shafts	5	3	4	6	8	2
Jumpers and cable connectors	7	1	8	9	2	3
Lateral motion, wheels	18	7	18	20	9	10
Lights, cab and classification	5	1	2	......	1	1
Lights, headlight	3	2	......	1	2	2
Meters, volt and ampere	3	3	4	2	2	3
Motors and generators	26	16	15	12	14	14
Pilots and pilot beams	23	15	8	1	2	4
Plugs and studs	......	......	......	1	......	......
Quills	16	18	52	29	18	9
Rods, main, side, and drive shafts	5	6	11	3	10	......
Sanders	106	82	57	50	59	41
Springs and spring rigging, driving and truck	44	63	42	38	44	18
Steam pipes	10	4	1	6	3	1
Steps, footboards, et cetera	116	68	29	28	25	25
Switches, hand-operated, and fuses	3	1	......	7	2	2
Transformers, resistors, and rheostats	6	2	3	......	......	3
Trucks	65	45	52	42	47	22
Water tanks	1	2	1	2	1	4
Water glasses, fittings, and shields	18	......	15	2	4	2
Warning signal appliances	7	8	2	......	2	3
Wheels	72	48	54	46	74	107
Miscellaneous	39	40	31	16	13	16
Total number of defects	1,745	1,442	1,385	1,212	1,026	849
Locomotive units reported	9,803	7,805	6,616	6,094	5,139	4,351
Locomotive units inspected	20,798	13,115	10,908	9,888	7,711	6,847
Locomotive units defective	853	633	499	447	378	298
Percentage inspected found defective	4.1	4.8	4.6	4.5	4.9	4.4
Locomotive units ordered out of service	21	19	17	16	9	6

Ninety-one boiler and appurtenance accidents other than explosions resulted in the death of 2 employees and injuries to 93 employees. This is a decrease of 11 accidents, an increase of 1 in the number of employees killed, and a decrease of 9 injuries compared with the preceding year.

Extension of Time for Removal of Flues

Three hundred and fifty-three applications were filed for extension of time for removal of flues, as provided in rule 10. Our investigations disclosed that in 57 of these cases the condition of the locomotives or other circumstances were such that extensions could not properly be granted. Four were in such condition that the full extensions requested could not be authorized but extensions for shorter periods of time were allowed. Ten extensions were granted after defects disclosed by our investigations were required to be repaired. Seven applications were canceled for various reasons. Two hundred and seventy-five applications were granted for the full period requested.

Locomotives Propelled by Power Other Than Steam

Forty-one accidents, resulting in injuries to 50 persons occurred in connection with locomotives propelled by power other than steam. This represents an increase of one in the number of accidents, a decrease of two in the number of persons killed, and an increase of nine in the number of injured compared with the preceding year.

During the year 4.1 percent of the locomotives inspected were found with defects or errors in inspection that should have been corrected before the locomotives were put into use; this represents a decrease of 0.7 per-

cent compared with the results obtained in the preceding year. Twenty-one locomotives were ordered withheld from service because of the presence of defects that rendered the locomotives immediately unsafe; this represents an increase of two locomotives compared with the preceding year.

Specification Cards and Alteration Reports

Under rule 54 of the Rules and Instructions for Inspection and Testing of Steam Locomotives, 111 specification cards and 4,265 alteration reports were filed, checked, and analyzed. These reports are necessary in order to determine whether or not the boilers represented were so constructed or repaired as to render safe and proper service and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found.

Under rules 328 and 329 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, 2,001 specifications and 173 alteration reports were filed for locomotive units, and 530 specifications and 231 alteration reports were filed for boilers mounted on locomotives other than steam. These were checked and analyzed and corrective measures taken with respect to discrepancies found.

Amended Rules

The Commission, in an order dated April 27, 1948, amended rules 106 (b), 153 (a), and 157 (c) and (d) which required equipment of steam road locomotives built on or after March 1, 1946, with emergency brake valves, means of ascertaining the height or quantity of water in the tender feed water tank from the cab or tender deck, and steam or auxiliary air supply to air operated reverse gears, and that steam road locomotives built before March 1, 1946, be so equipped the first time class 3 or heavier repairs were applied after June 1, 1946, but not later than June 1, 1948, by eliminating the words "but not later than June 1, 1948."

The amendment leaves in effect all the original order except that part which requires the equipment before June 1, 1948, of locomotives built before March 1, 1946. Installations on these locomotives receiving Class 3 or heavier repairs are continuing until all such locomotives are so equipped.

One case of violation of the rules and instructions for inspection and testing of steam locomotives and tenders and their appurtenances, comprising three counts, was transmitted to a United States attorney for prosecution. This case is now pending in the district court.

No formal appeal by any carrier was taken from the decisions of any inspector during the year.

Weighing Locomotives and Trucks

By E. L. Laidlaw* and Stanley Boddy*

Ring gauges provide an accurate and convenient means of determining weight distribution as well as total weight—Deformation of the rings is measured by dial gauge—Ring and dial gauge are calibrated together

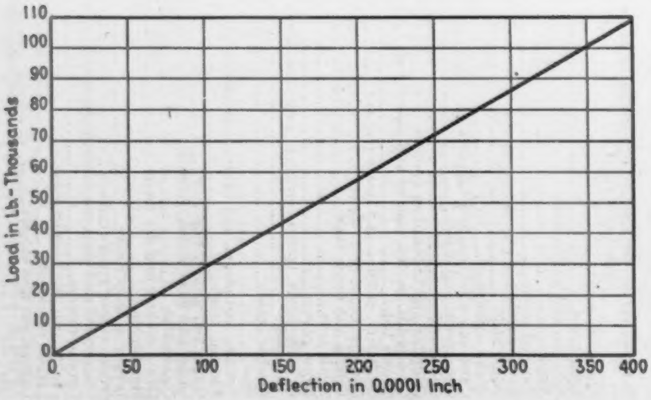
RING gauges have been used for several years in the shops of the General Electric Company for weighing locomotive cabs and trucks during the process of assembly. This method of weighing is convenient and rapid, as it does not necessitate the removal of the equipment from the assembly floor. The error in weighing is held to less than one-tenth of one per cent over the entire range of weights encountered.

A ring gauge consists of a steel ring which may be loaded so as to deform it very slightly. The deformation is measured by a standard dial gauge, supported inside the ring, which measures changes of the inside diameter at the point where the load is applied. The ring gauge and dial gauge are calibrated together in a standard testing machine, so that the load supported on the ring can be obtained directly from the reading of the dial gauge.

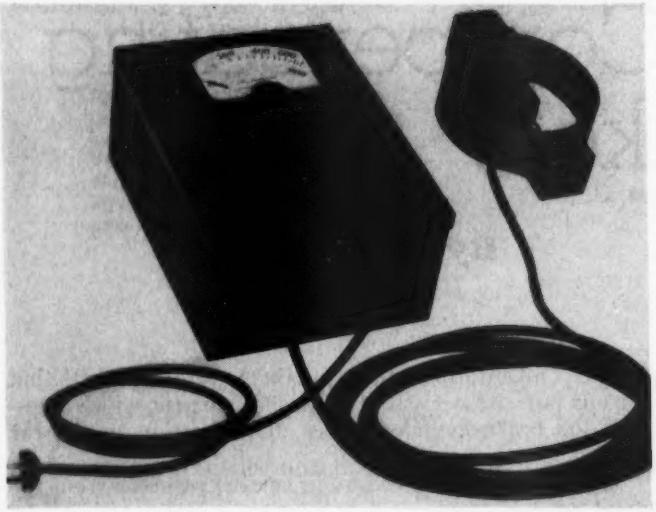
The ring gauge is made of one per cent carbon steel. It is heat-treated to a hardness of approximately 385 Brinell. It is 19 in. high, 12 in. wide and 4 in. deep. The ring is 2 in. thick.

The gauge has two saddle supports, one holding the dial indicator and the other holding an anvil on which the stern of the indicator rests. The dial face scale has 200 divisions of .0001 in. each, numbered in a clockwise direction. The gauge shown is designed for 100,000 lb. At this load, the indicating needle rotates approximately

*Works Laboratory, General Electric Company, Erie, Pa.



Calibration curve of a 100,000-lb. ring gauge



Ring gauge with remote reading electric indicator

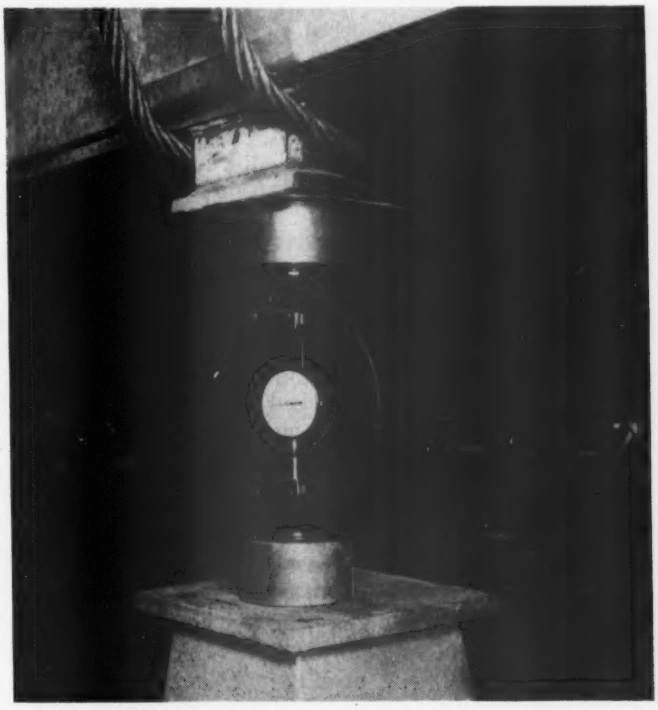
350 divisions. The load plotted against the deflection is a straight line. The gauge, if used in both compression and tension, should be calibrated in both directions, as there is a slight difference in the slope of the two curves.

The gauge is constructed with threaded ends so that it may be used in tension. When used in compression, caps are screwed on the ends so as to distribute the load over a larger area to give greater stability, and to protect the threads. The complete gauge with end caps weighs 115 lb.

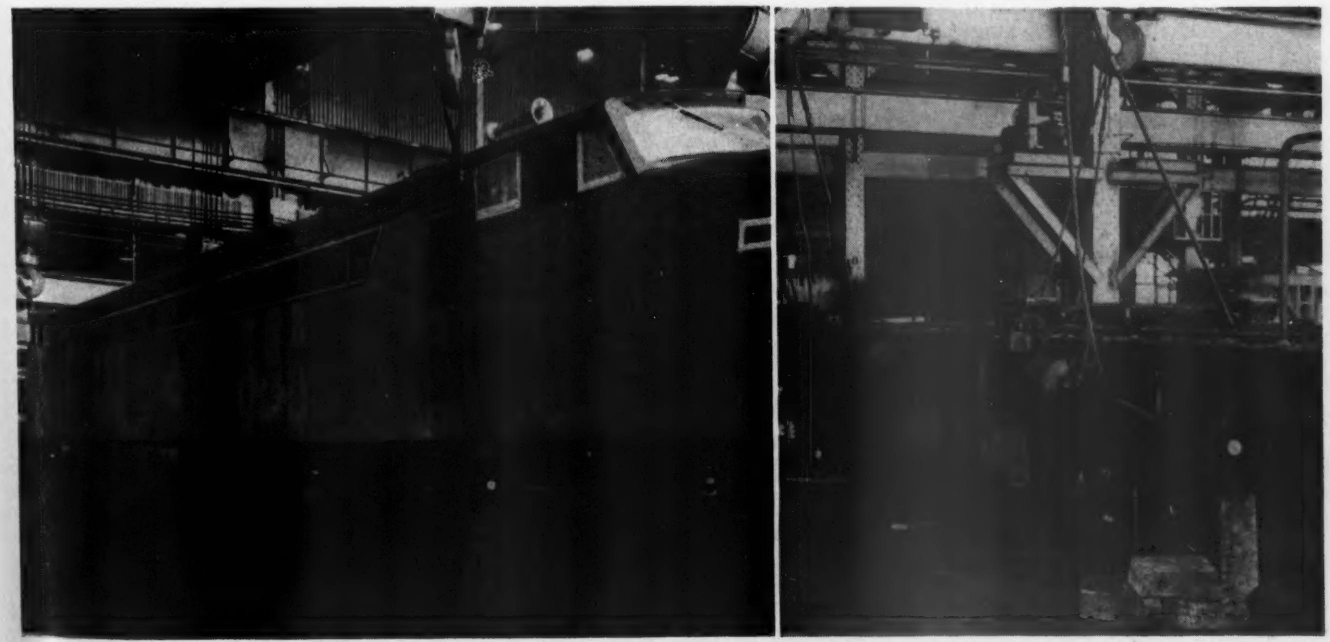
When weighing a locomotive cab by this method, it is first lifted from the pedestals on which it has been supported during assembly. The gauges are then mounted on the pedestals and the cab lowered on four gauges. The readings are taken on each gauge, and the actual weight computed from the calibration curves for the four gauges. By taking measurements of the location of the gauges, the weight distribution can also be calculated. When the readings are to be used for this purpose, care must be taken to have the cab level during the weighing process.

Other component parts of the locomotive, such as trucks, can be weighed in a similar manner.

Similar gauges, usually smaller in capacity (down to 10 lb.) are used as a simple means of measuring many types of loads. They are also used for the calibration of presses, and in spring testing equipment, etc. This type gauge has the advantages of light weight, simplicity of design, accuracy, and ease of application. The only precaution that must be observed when using a gauge with a standard dial indicator is that the load must not be applied or released instantaneously, otherwise the moving parts of the indicator may be damaged. By substitution of an electric gauge in place of the dial indicator, readings may be obtained at remote points.



Ring gauge used for weighing locomotive cab



Locomotive cab with gauges in position for weighing—(Right) Locomotive truck with gauges in position for weighing

The AB Load Compensating Brake*

By C. D. Stewart †

In 1948 there was developed a brake that automatically adjusts the braking forces according to the change in the loading of the cars. Its name, the Load Compensating Brake (ABLC equipment) identifies the new principle which it incorporates. The eightieth anniversary of the invention of the air brake has been signalized by the introduction of the fifth major addition to the functional features of the brake.

Of these five changes, four had to do with improving the *rate* of development of brake cylinder pressure on the individual cars and throughout the train and new control valves were required in each case. This fifth change has to do with improving the braking forces resulting from the brake cylinder pressures and the present standard AB control valve is retained.

Before discussing the reasons for this basic change it might be helpful to describe briefly the new function of the load compensating brake. The variations in the loading of the car are automatically registered by a weighing mechanism at the time that the car is being loaded or unloaded. At the completion of either process the mechanism is automatically locked and no further change takes place until the loading is again changed.

Our primary interest tonight is the manner in which the braking forces produced by the normal and retained features of the standard AB control valve are adjusted by the additional and combined actions of the compensating valve and the compensating brake cylinder, to produce *more uniform* braking ratios on mixed trains and *materially higher* braking ratios on loaded trains than is now possible with the use of the AB control valve alone.

The four important elements of the load compensating equipment are the standard AB control valve, a three compartment reservoir, a load compensating valve, and a compensating brake cylinder. The AB control valve, being standard in every respect, needs no discussion at this time. Two of the three reservoir volumes are the standard AB auxiliary and emergency reservoirs. A third and considerably smaller volume is added to provide the desired brake force compensation.

*Abstract of a paper presented before the New York Railroad Club, Jan. 20, 1949.
†Vice-president, Westinghouse Air Brake Company.

The compensating valve contains several elements, but for our purpose we will refer to that element which regulates the brake cylinder forces in proportion to the car loading.

The brake cylinder differs in several respects from the standard AB single capacity brake cylinder. First, the cylinder is 12 in. in diameter instead of 10 in. This large size is required to produce the higher braking forces desirable for loaded cars. Second, nominal piston travel is 5 in. instead of 8 in. The shortening of the piston travel is to keep the air consumption, when the car is loaded, within the amount required by the 10 in. single capacity brake cylinder having 8-in. piston travel. Years of experience have shown that the volumes now employed on freight cars are about the maximum that can be handled efficiently during both brake application and release. The third difference is in the use of air under pressure on both sides of the brake cylinder piston when the car is not heavily loaded. Air under varying pressures is allowed to act upon the push rod face of the brake cylinder to offset that portion of the pressure upon the opposite face of the piston which is not required when the car is only partially loaded or empty.

Having gained an impression of the outward appearance of these parts, let us look inside for a better understanding of the manner in which they perform their primary function. The compensating valve contains a pneumatic-mechanical balancing mechanism with a weighing beam supported on a movable fulcrum that is shifted automatically through the truck spring deflection during a change in car loading. The manner in which this scale beam mechanism regulates the braking force will be described later.

The 12-in. brake cylinder has a conventional 12-in. piston and packing cup with a standard piston return spring and hollow rod. In addition to these, there is a second and larger hollow rod, outside the first and having its inside area connected to the atmosphere. The chamber surrounding this second hollow rod and on the back of

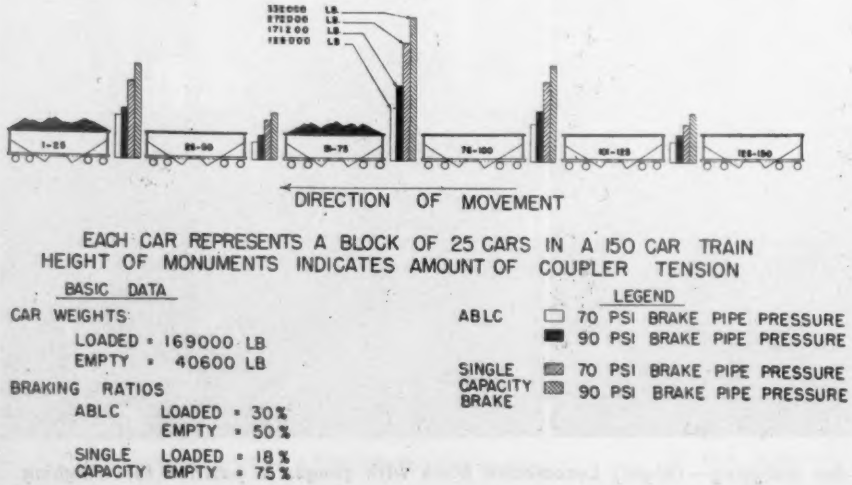


Fig. 1 — Comparison of load compensating and single-capacity brake—Coupler forces in train of mixed empties and loads during emergency stop at 10 m.p.h.

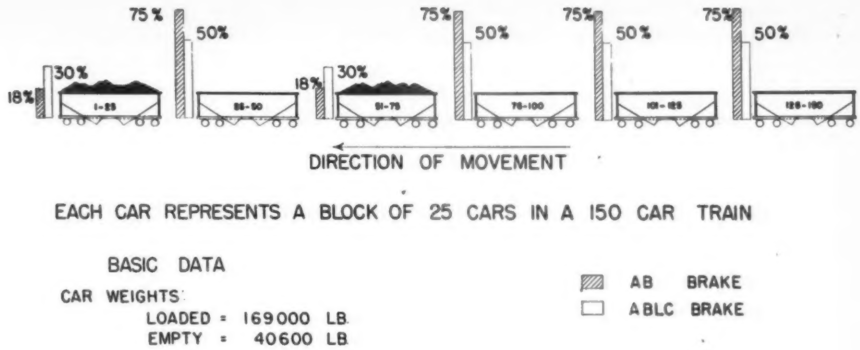


Fig. 2 — Comparison of load compensating and single-capacity brake—Variation in breaking ratios throughout train of mixed empty and loaded cars

the piston is called the compensating cylinder. It is sealed against air leakage by a second packing cup.

In order that we may see how this brake performs, first when the car is loaded and then when it is empty, let us assume that the car is loaded and that a brake application is being made. Air flows from the AB control valve to the face of the 12-in. brake cylinder piston forcing it outward. This action in turn presses the brake shoes against the car wheels. With a full service application of 50-lb. brake cylinder pressure, a force of 5,650 lb. is developed at the push rod. By a suitable multiplying leverage system this force provides 30 per cent braking ratio for the fully loaded car. Air under pressure likewise flows to the compensating valve chamber but, although this pressure acts on a diaphragm above the scale beam, it can not depress the beam because the fulcrum is under that end.

When the brake is released and the car unloaded the fulcrum pin has moved to a mid position under the scale beam. Now when the brakes are again applied, air under the same pressure goes to the 12-in. brake cylinder piston forcing it outward in the same manner and the air that formerly went to the control valve and did nothing, now is able to depress the scale beam. The opposite end of the beam thereby is raised, unseating a check valve and permitting air to flow from the compensating reservoir volume by way of this check valve to the compensating brake cylinder chamber in back of the brake cylinder piston. In the assumed case this air pressure is the same as that on the other side of the piston, but because a relatively large area of the back portion of this piston is connected to atmosphere the effective opposing force is less than the force on the full area of the reverse side of the piston. The net braking force at the push rod with a full service brake cylinder pressure of 50 lb. is only 2,270 lb. in place of the 5,650 lb. force developed while the car was loaded, and there was no opposing pressure in the front portion of the brake cylinder. This compromise force produced a braking effort of between 50 and 60 per cent of the lightweight of the car.

When the car is only partially loaded, as already explained the fulcrum under the weighting beam is located in some intermediate position. Under this condition a given pressure on the power end of the scale beam will produce a different pressure on the opposite end and as a result the pressure in the compensating chamber of the brake cylinder will be lower than the pressure on the piston face. When the car is three-quarters to fully loaded the pressure in the compensating chamber becomes atmosphere and consequently there is no force opposing that on the piston face.

It might be advisable to explain why a definite 30 per cent braking ratio is employed for the loaded car and an indefinite 50 to 60 per cent range in braking ratio is permitted for the empty car. It is obvious that the loaded car braking ratio is the paramount factor in controlling and stopping a loaded train. It should, therefore, be the

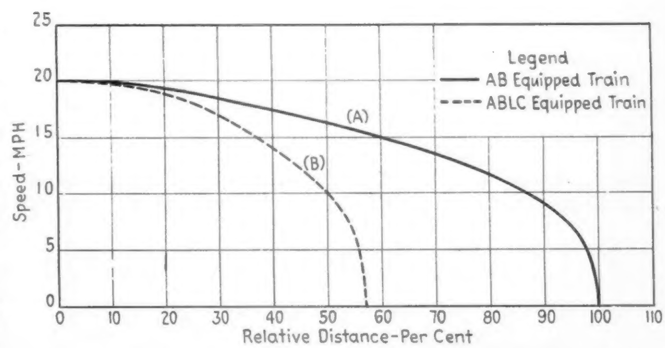


Fig. 3—Comparison of load compensating and single-capacity brake—Characteristic stop on 1.74 per cent descending grade

one that is definite and substantially uniform. The light weight braking ratio on the other hand is not so important from the standpoint of train movement control. Therefore, as an economy measure permitting the use of but one cylinder size for the various empty car weights, this range in empty car braking ratio is proposed.

We now come to the second phase of our discussion. What are the reasons for the development of this type of freight brake equipment? It is not sufficient to say that the purpose of a brake is to stop a train, because a stone wall would do the same thing. A brake must be capable of stopping a train quickly, but without excessive slack action that might be damaging to cars and lading. This problem is complicated because the cars in a train must of necessity be coupled with some degree of free slack, and under the present conditions the brakes throughout the train cannot be applied simultaneously. Because of these factors changes in the type of brake have been necessary to meet operating conditions and practices as they have developed. Three such major changes in operating conditions have taken place since the air brake was originated. One such change is in the gross to tare ratios of the cars and the lading; a second is in the number of cars hauled in the trains; and a third is in the speed at which these trains are operated.

The quick action triple was developed primarily to make practical the handling of 50-car instead of 25-car trains, then the maximum that could be handled safely with the straight air brake. In 1886 the Master Car Builders, the predecessor of the A.A R. Mechanical Division made public announcement of the desire to operate trains of 50 cars and invited manufacturers to design and submit brakes for trial that would handle such trains successfully. Over a period of two years eight manufacturers submitted brake equipments for test on the Burlington railroad and none of them met the requirement of train slack shock. It is interesting to note that four forms of electrically actuated brake were submitted for trial. Following a discouraging report by the M.C.B., Mr. Westinghouse conceived the idea of the Quick Action Brake. But, because the two years of trials of the various forms of brake sub-

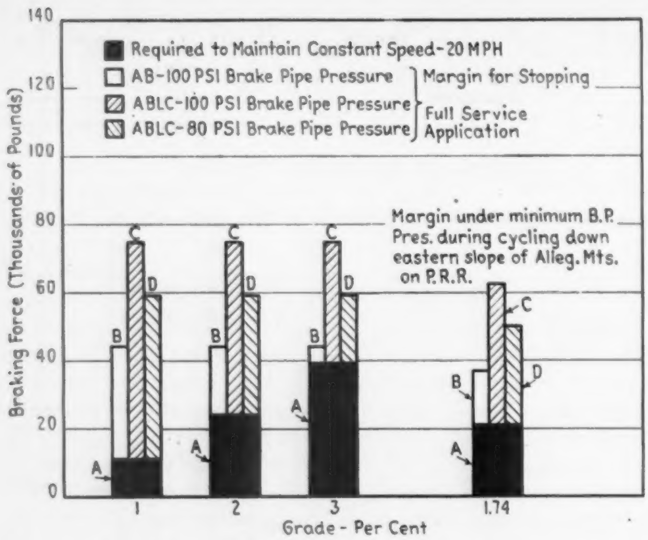


Fig. 4—Comparison of load compensating and single-capacity brake—Reserve braking power during grade cycling

that a predetermined control of the brake cylinder pressure build-up was necessary, if damaging slack shocks were to be avoided, following which the existing form of AB equipment was produced to include this feature. The road trials were then resumed and 150-car trains, empties, loads, and mixed empties and loads were handled successfully.

It is highly important to direct attention to the fact that the empty car braking ratio employed at the time of these tests was 60 per cent maximum based on 50-lb. brake cylinder pressure.

Since that time car designs have become more efficient and the gross to tare ratios in general have been increasing, in some instances markedly so. As a matter of fact, within four years after the AB equipment had been adopted, the maximum gross to tare ratio had increased to the point where it was necessary for the A.A.R. Brake Committee to deliberate on the next step to be taken in order to halt the continuing reduction in braking forces of loaded trains. The practice of using 20 per cent braking ratio, based on 50-lb. brake cylinder pressure, for loaded cars, had been followed for a good many years and it was

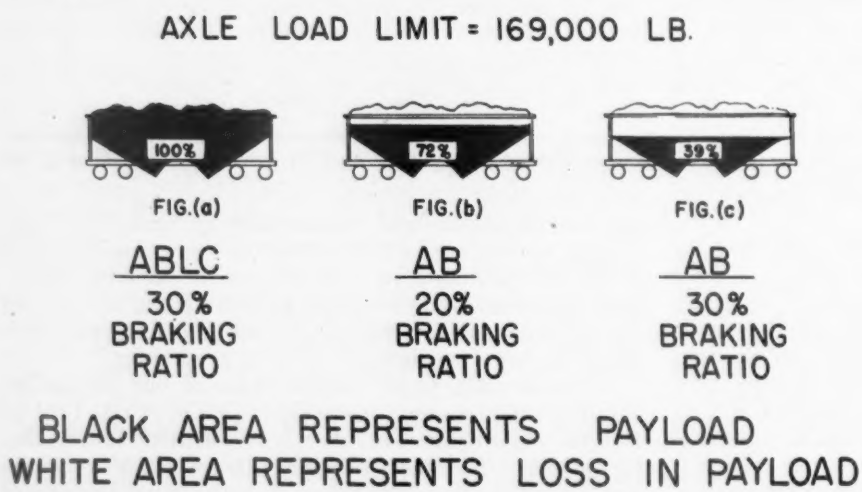


Fig. 5—Permissible payloads in 35,000-lb. car with load compensating and single-capacity brake

mitted had ended in failure, the M.C.B. did not feel that it was worth while to continue the tests to demonstrate the merit of this improvement. Whereupon Mr. Westinghouse at his own expense equipped a 50-car train with quick action triple valves and demonstrated it successfully at different places in the country, and as a result this form of brake was adopted as standard.

By 1905 it was desired to handle still longer trains and the K Triple Valve was developed and finally standardized in 1911. This brake was tested on trains of 80 cars at different points in the country and this train length then became common. During succeeding years even longer trains were desired and by 1925 requests were made to develop an equipment that would handle 100 cars successfully. Such an equipment was developed, tested in the A.A.R. laboratory at Purdue, and finally approved for road trial. However, when the trials were about to start, it was suggested that because of the length of the time that had been required for this development, it would be desireable to test this equipment on 150-car trains in order that such elaborate tests would not again have to be undertaken for a period of years. The equipment was found to work entirely satisfactorily on the 100-car trains, but when 150 cars were tested, prohibitive train slack shocks were experienced. As a result the train testing was temporarily suspended and pure research tests were undertaken to determine what additional functions were necessary for slack control in trains of this length. It was during these pure research tests that it was proven

considered by those with extensive railroad experience, that this 20 per cent should be the minimum value even for the shorter train lengths and lower speeds prevailing at that time. The trend toward lower values was therefore definitely undesirable, in fact it was recognized that a somewhat higher value would have a number of advantages. After many months of deliberation, the Brake Committee members concluded that, with the gross to tare weight ratios then coming into common use and with only the single capacity brake available, the only expedient to which they could resort was the authorization of an increase in the empty car braking ratio. The committee, therefore, reluctantly agreed to permit an increase from 60 per cent to a maximum of 75 per cent. With the exception of refrigerator cars and cattle cars, most freight cars built since that time have an empty car braking ratio higher than 60 per cent and frequently approaching 75 per cent. I have been informed that there are cars braked higher than 75 per cent and lower then 18 per cent. Such loaded car braking ratios are inadequate for heavy grades and for modern speeds on level roads. Also when empty and loaded cars having these extreme braking ratios are assembled in the same train, severe slack action and high draw bar forces result. If the empty cars were to be located toward the rear of the train, stretching forces in the draft gear would result as represented by Fig. 1. Were the location of the cars to be reversed the compression forces would be represented by a similar chart, but turned upside-down.

Fig. 2 may help visualize why the drawbar forces are lower on trains of mixed empties and loads when the ABLC brake is used. As indicated by the height of the columns, the variation in braking ratio throughout the ABLC equipped train is very slight compared to that in the AB equipped train. When the braking force is equal on all cars, as is the case with the single capacity brake, a greater spread in braking ratio results and it is necessary for a considerable amount of the braking force on the empty cars to be transmitted through the draw bars to help stop the loaded cars.

Referring now to another type of operation. If 18 per cent is employed on heavy descending grades, the distances required to stop such a train in comparison with a train of cars having 30 per cent braking ratio is illustrated in Curves A and B of Fig. 3.

Fig. 4 has been included as a matter of further interest to show the braking ratio required to control the speed of a loaded train during grade operation at twenty miles per hour. This is shown for several different grades and several different maximum service braking ratios. Those portions of the columns marked *B*, *C*, and *D* indicate the reserve braking forces available for stopping the train from a speed of 20 m.p.h. above the forces required to hold the train speed constant. The latter are indicated by the portions of the columns marked *A*. The columns marked *B* show the margins of force available with the single capacity brakes employing 100-lb. brake pipe pressure. The columns marked *C* show the margins provided by the load compensating brake with 100-lb. brake pipe pressure, and the columns marked *D* show the margins provided by this same brake when only 80-lb. brake pipe pressure is used. The margins shown for the one, two and three per cent grades have been calculated on the basis of a fully charged train as obtains at the beginning of the descent, while the margins shown for the 1.7 per cent grade are those found available following the runs down the eastern slope of the Allegheny mountains on the Pennsylvania. Even with 80-lb. brake pipe pressure the ABLC equipment provides a greater margin for stopping than the single capacity brake equipment with 100-lb. brake pipe pressure. There are a number of advantages in using lower brake pipe pressure, among them being, first the fact that the brake equipment was designed to operate on lower pressure, second it is more economical to compress air to a lower pressure, and third there is, of course, less likelihood of burst hose.

Still another advantage of more uniform ratios is a reduction in damage claims. The cost of damage to lading has been growing at a very rapid rate during the past few years. While it is true that some of this damage is done during humping and other similar car movements, improvements in car wheels, trucks and friction draft gears have had beneficial effects so that there is good reason to believe that much of this damage is done by internal shocks in the train brought about by the variations in braking ratio existing between cars. In order to avoid detrimental slack action in trains as the length of these trains increases, it was necessary to make the fourth fundamental change in the brake design which is now incorporated in the AB equipment. In spite of the vast improvement in train slack control brought about by the improved brake performance produced by the AB single capacity brake the longer trains that this brake made possible, and the concurrent increase in the gross to tare ratios now necessitate the fifth change, namely, a braking ratio adjustment. It is easy to visualize the increase in train lengths from 50 cars in 1888 to 150 cars 60 years later, but not so apparent is the change in the gross to tare ratio of these cars. This change has been going on gradually and it is my impression taht there are few railroad men aware that a marked change has taken place or of the effect this changed condition has in the control of the train slack.

It is our business to be aware of these trends and so a few years ago we undertook the development of the

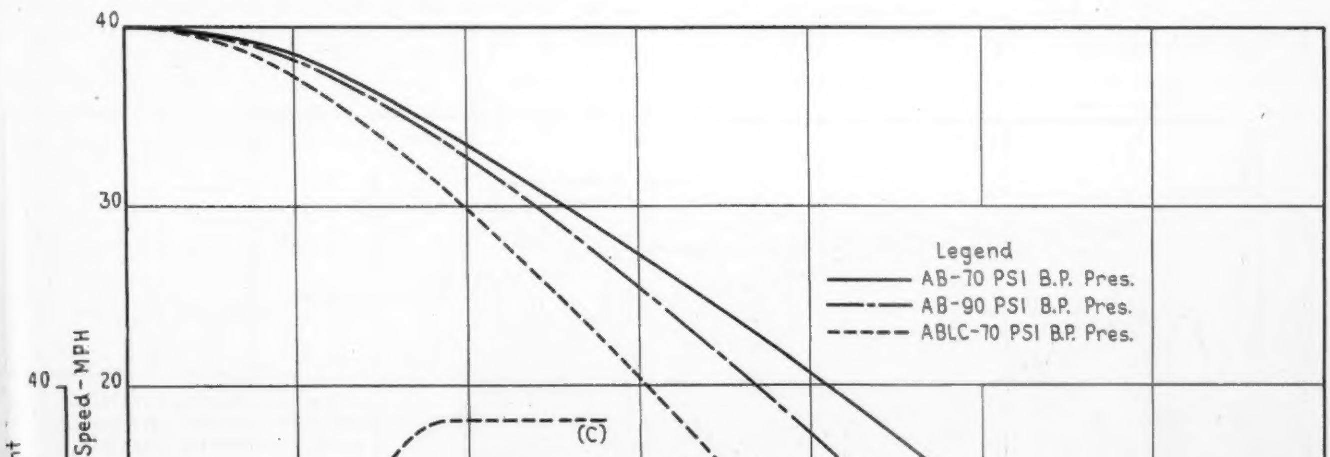


Fig. 6—Comparison of load compensating and single-capacity brake—Braking ratio development throughout train of 150 loaded cars with corresponding speed time curves

load compensating brake. While it is true that the consideration of especially light weight cars stimulated us in our search for an answer to the problem, I think you will agree that what I have revealed to you respecting the gross to tare ratios on many normal weight cars of today also justifies this equipment.

When considering light weight cars, the load compensating brake at 30 per cent loaded car braking ratio, ratio is to be retained on the loaded car without sacrificing a very substantial pay load.

Fig. 5 illustrates the situation that exists with a 35,000-lb. car a number of which are now in service and equipped with the load compensating brake. Using the load compensating brake at 30 per cent loaded car braking ratio, this car can be loaded to its axle load limit of 169,000 lb. as shown in *a*. Were the single capacity brake used, the amount of pay load would have to be reduced as shown in *b* and *c* in order to maintain the braking ratios indicated. Fig. 5 also represents the gain in pay load capacity made available by the load compensating brake.

The load compensating brake is designed to provide higher braking forces for loaded cars and lower braking forces for empty cars. This dual accomplishment is impossible with the single capacity brake, but it may be thought "half a loaf is better than none" and, therefore, why not secure higher braking forces for the loaded cars by the relatively simple expedient of raising the system pressure? Road tests have demonstrated conclusively that the improvements in stopping distances are not nearly in proportion to the increase in system pressure. In order to determine the reason for this, a thorough investigation was undertaken using a 150-car stationary test rack. By means of recording gages located at different points in the train, the amounts and the times of full brake cylinder pressure development could be shown clearly. It will be appreciated that to show on the chart the brake cylinder cards taken at the various places in the train would make it quite complicated and take more time to explain than is at our disposal tonight. Therefore, one composite card has been made representing the average for the train for each of three different conditions. Furthermore, in place of showing these curves as brake cylinder pressure-time curves, we have converted them to braking ratio-time curves. Fig. 6 shows the average braking ratio-time curve for three typical conditions. Curve *A* illustrates the rate of development of braking ratio on a 150-car train with the single capacity AB brake using 70-lb. brake pipe pressure. Curve *B* illustrates how this rate of development is increased when 90-lb. brake pipe pressure is used with the same brake. Curve *C* illustrates the increase in rate when the ABLC equipment with 70-lb. brake pipe pressure is used on the same train.

In order to show the effect of these build-up rates on stop distance the speed-time curves corresponding to the three braking ratio development curves has been prepared. The ABLC equipment curves demonstrate the marked improvement in the braking ratio made available when most needed, namely, early in the stop, while the train is traveling at high speed; on the other hand, with the single capacity AB brake there is little increase during the first nine seconds. During an actual road trial, two stops were made with an AB equipped train using the two brake pipe pressures shown, and although in the second test the increase in brake pipe pressure was 29 per cent, the decrease in stop distance was only six.

Altoona Tests

Finally, the third phase of this discussion relates to road tests that were made by the A.A.R. last summer. One hundred fifty hopper cars belonging to the Illinois Central, having an empty weight of 35,000 lb., were brought to the test tracks near Johnstown, Pa., and Altoona on the Pennsylvania Railroad. This happens to be the same location on which the AB brake tests were made by the A.A R. in 1933 and as far as it was practical to do so, the 1948 tests duplicate those with the AB brake. First, a train of 150 empty cars was tested with service and emergency applications on level track at speeds ranging from 5 to 40 m.p.h. in substantially five-mile steps. Next, 50 of the cars were loaded with coal and mixed in the train so that the consist was 25 loads, 25

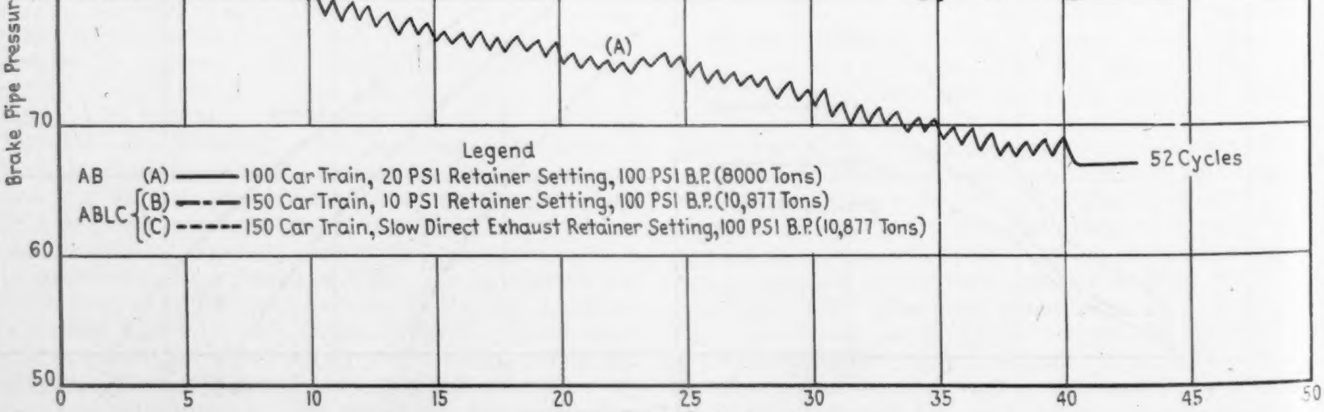


Fig. 7—Comparison of load compensating and single-capacity brake—Rear end brake pipe pressure during various runs down eastern slope of Allegheny mountain on Pennsylvania

empties, 25 loads and 75 empties. Speeds and type of brake applications were the same as for the empty train. Next, all of the cars were loaded with coal and again similar tests were run. With 70-lb. brake pipe pressure, the braking ratio for the empty cars was 50 per cent and for the loaded cars was 30 per cent. This compared with 60 and 18 per cent for the train as tested in 1933.

Throughout these tests the brake performance was highly satisfactory. Numerous graphical records were made at various points in the train and the data of chief interest related to the stopping distances and the degree of slack action in the various portions of the train. During the 1933 tests there was established a yardstick for measuring tolerable slack shock. During the 1948 tests using the same instruments the slack shocks were never greater and in most cases were less than those experienced with the single capacity brake. There were those who anticipated that the slack shocks would be more severe because the loaded car braking forces with the load compensating brake are at least 50 percent higher than with the single capacity brake. With the train of mixed empty and loaded cars, the drawbar strains were much less, but, of course, this is to be expected because of the great decrease in spread between the braking ratios on the empty and loaded cars. The stopping distances for the empty car train were longer; for the mixed empty and loaded train were approximately the same, and for the loaded train were less. The improvements in the loaded train stop distances increased with the increase in speed as would be expected.

The empty car train was taken to the Horse Shoe Curve where a grade of approximately 1.8 per cent for about 11 miles provides conditions excellent for grade testing. The empty train was handled down this grade without incident and the performance compared favorably with the similar test run made with the AB brake. Two runs down the grade were made with the train of 150 loaded cars, first with the pressure retaining valves set in their 10-lb. retained position and then with the retaining valves in slow blowdown position.

The 1948, 150-car loaded train weighed 11,000 tons, the 1933 loaded train consisting of only 100 cars weighed 8,000 tons. Those familiar with heavy grade braking know that the means for determining the adequacy of the brake is to note the degree of fall in brake pipe pressure at the rear end during the descent of the grade. The 8,000-ton train tested in 1933 was the heaviest train to be taken down such a grade up to that time. Although the brake performance was satisfactory, the reserve in brake pipe pressure would have been inadequate if the grade had been longer. The 11,000-ton train, 37.5 per cent heavier, handled last summer reached the foot of the grade with 21 per cent higher pipe pressure notwithstanding the use of the slow blowdown retaining valves.

This attainment suggests wide and significant implications. When sufficient cars are equipped with the load compensating brake, the retaining valve need not be employed except on a few heavy grades and the substantial economies resulting therefrom are obvious. Not only will there be the saving in the cost and maintenance of the retaining valve, but also the much greater saving from eliminating first the cost of manipulating the retainers at the top and bottom of grades, and second the expense of holding the trains for the time required to make the adjustments. The anticipated saving from such a procedure is so marked that one railroad plans to equip a group of cars and keep them in segregated service in order that the immediate benefits of non-use of retaining valves may be realized. Fig. 7 shows the brake pipe pressure during the cycling action down the Horse Shoe Curve grade for three loaded train conditions.

Curve A of Fig. 7 covers the 100-car AB train taken down this grade in 1933 road tests. It had a weight of 8,000 tons. It started down the grade with 100-lb. brake pipe pressure and the retaining valves set in 20-lb. position. Curve *B* shows the 150-car train tested last summer. It had a weight of 11,000 tons. It started down the grade with 100-lb. brake pipe pressure and the retaining valves set in 10-lb. position. Curve *C* is the same train and all conditions are the same except that the retaining valves were placed in the slow blowdown position.

These road tests were made under the auspices of the A.A.R. A report was written and is in the hands of mechanical officers. It is now being studied and those of you who are expected to vote on matters of this nature will do so within the next few months. This is an important matter; it merits more than the usual consideration.

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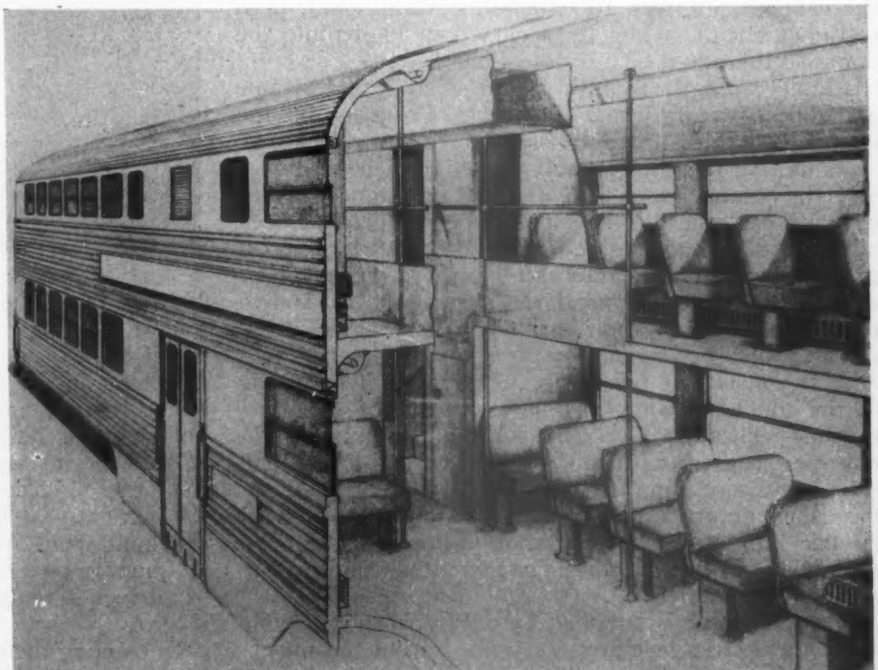


Cut-away drawing of a gallery-type coach which the Chicago Burlington & Quincy will put in service on suburban trains—The cars, thirty of which are being ordered from the Budd Company for 1950 delivery, will seat 93 passengers on the main floor and 52 in galleries, a total of 145—The cars will have double doors at the center

Caboose Interiors Streamlined

ONE important feature of the 16 new 30-ft. steel sheathed cabooses, built at the St. Cloud, Minn., shops of the Great Northern last year, is the attention given to crew comfort and safety.

The cars are equipped with well-lighted desks and comfortable double seats at opposite corners, also two bunks, ample locker, toilet and washing facilities. A coal-fired stove and combination provision-ice box, with small locker at the top, complete the major items of equipment. To avoid possible injuries to crew personnel under shocks incident to freight train operation, the caboose interiors are streamline throughout, even to the extent of setting the locker door knobs into the doors so there will be no projections.

Ample strength is built into the steel underframe and superstructure frame of this car. Posts and braces, integrally welded to the superstructure, are rolled steel sections. All sheathing is butt-welded to the side frames and the seams ground to give straight and smooth exterior car sides. The cupola-type design has been adhered to instead of side bay windows in the interest of greater overall clearance, to avoid any danger of sideswiping by shifted loads on passing trains, and to permit better observation of the train as a whole.

The cupola seating used is new on the Great Northern. It consists of two facing seats, one on each side of the cupola, arranged as shown in one of the illustrations. These seats, 29 in. wide, are upholstered in imitation leather and furnished by Heywood-Wakefield.

The caboose interiors are lined with plywood in varnished natural finish. All cars are equipped with electric lights and rear-end spot lights which can be controlled as to direction by a man sitting at the corner desk inside.

Electric power is supplied by a Wincharger 12-volt 400-watt electric generator, suspended from the underframe of each caboose. This is driven with endless V-belts from the pulley mounted near the center of one of the axles. An Exide battery, located under one of the bunks, is of 157 amp. hr. capacity.

Conventional friction draft gears of the Miner A-28X-B type are installed. Trucks are of the swing-bolster type built by the Great Northern. Timken roller bearings are installed on the first car of the lot, the other 15 cars having plain bearings.

Diagonally striped handholds and end boards and six round white spots along each side sill are considered an important safety factor because they are more likely to attract attention during daylight and after-dark service.

In painting these cars, infrared drying was used which hardens paint in 20 minutes.

EDITORIALS

Some Facts About Refrigerator Cars

There are about 134,700 refrigerator cars in service in the United States at the present time and this equipment, if coupled together on a single track, would be more than enough to stretch from New York to Chicago. Many essential facts about refrigerator car equipment are little known to the general public and perhaps not fully appreciated by most railroad men, themselves.

One important fact, among others emphasized in a discussion of the subject by K. C. Underwood, president of the Merchants Despatch Transportation Corporation, at the February 14 meeting of the Western Railway Club, is the necessity of providing as nearly as possible all-purpose cars. A limited number of refrigerators designed for special loading, such as dry-ice and frozen foods, for example, are serving a definite transportation need, although it seems probable that the new general-service cars with 4 in. and 4½ in. of insulation and side-wall flues may meet the frozen-food requirements. In the main, however, efficient all-around cars which can furnish refrigeration, heater, or ventilation service for many different commodities lend themselves to prompt movement of loads, quick redistribution to points where needed and proportionately reduced empty mileage.

In this connection, Mr. Underwood presented some performance figures which are of unusual interest. With 10,000 fewer refrigerator cars in 1947 than in 1940, railroads in this country handled 570,347 more carloads of perishable freight, the total number of carloads in 1947 being 2,370,405. Although 75 per cent of these perishable products are delivered to the northeastern part of the United States, the distribution of refrigerator cars and their return, loaded with dead freight whenever possible, is carried on so effectively by the combined efforts of individual railroads, the Association of American Railroads and the car owners, that a 62 per cent loaded movement is secured.

Railway mechanical-department officers are primarily interested in refrigerator-car equipment from the standpoint of design and maintenance which have such an important bearing on the kind of service rendered. The modern car of conventional design does not differ greatly from its prototype of 20 or more years ago as far as the general public can observe. It is, however, substantially stronger owing to steel construction in all highly stressed parts; has more efficient insulation; improved cooling equipment, largely by means of circulating fans and side air ducts; modern heaters with temperature-indicating or control devices; and easy-riding trucks equipped to dampen spring vibration.

Between six and seven million tons of ice are used annually in the icing of refrigerator cars and the question of why mechanical refrigeration has not been developed for this service was frankly raised and answered at the meeting referred to. The fact is that many ideas of promise along this line have been tried during the last quarter of a century and failed to meet the hurdle of practicability and economic justification. With only one refrigerator-car load in three requiring cooling, it is difficult to figure a large return on investment in mechanical refrigeration equipment. Additional disadvantages are that this equipment will add to the dead weight of the car both when loaded and empty and necessary servicing and maintenance are difficult to secure with equipment which moves about the country largely unattended.

Mechanical-refrigeration and temperature-control developments are now under way which hold some promise of changing this picture. Railroads are co-operating in initial tests and, dependent upon results, may have a chance to prove the oft-repeated contention that they will be quick to adopt any devices which demonstrate ability to give improved refrigerator-car service, especially if it can be done at reduced cost.

Now We Have To Make It Work

In recent years the railroads have acquired an enormous amount of electrical equipment. In the same period they have not made a corresponding addition to their electrical-department staffs. The net result is that mechanical-department men, many of them without technical training, must operate or maintain complex electrical equipment. Even electrically trained men must attend special study courses to learn the intricacies of such things as Diesel-electric locomotive controls, car electrical apparatus, air-brake equipment, air conditioning, etc.

Some mechanical men have said, "I'll stick to steam locomotives. Let someone else look after Diesels". Others say, "The complicated Diesel controls work beautifully and they seldom fail, but when they do, we are in trouble. Might it not be better to get just a little less out of the locomotive and have the thing simple enough for us to understand?" Still other mechanical men have completely familiarized themselves with such controls and are making a splendid job of getting the most out of them.

The inescapable fact is that the Diesels and the air-conditioned cars, and all the other ramifications of elec-

trical equipment are here. They are in service on the railroads and they must be made to earn a profit on the investment they represent. They were designed and purchased for this purpose.

The obvious need is a broadening of the understanding of such things. A few operators, supervisors and shop superintendents need to know the whole story, but most of the others involved are to a certain extent specialists. A major difficulty is to determine what each one wants and needs to know.

To assist in fulfilling this need, the *Railway Mechanical Enjineer* maintains a "Consulting Department" in which questions of current importance are raised and answered. The subjects cover a wide range, such as: "What effect does commutator condition have on brushes?"; Why do Diesel motors heat at low speeds?"; "How can I tell I am applying my solderless connectors properly?"; "How can we get our money's worth out of a lighting installation?"; "How does dynamic braking work?"; "How can I be sure my motor coils are thoroughly impregnated?", etc.

If you have any such questions for which you would like to have the answer, or the discussion of which would help to improve conditions on your railroad, send them to the Electrical Department, *Railway Mechanical Engineer,* 30 Church street, New York 7, and answers will be found.

Production Engineering

This nation has achieved its industrial greatness largely through its ability to develop and apply the principles of mass production. For the railroads the end products of their efforts in the application of these principles are mile-long freight trains and streamline passenger trains moving at high speeds. However, the same kind of talent that has been used in the mass production of ton and passenger miles has not been used in the shops and terminals where the motive power and rolling stock are maintained and serviced to increase the output and decrease the costs except in some relatively few instances.

There has not been a widespread recognition among the railroads of the value of production engineering to its shop and terminal work. The exceptions are those railroads which are fortunate in having engineers who know how to apply production principles to shop and terminal operations and managements that will back up their ideas by approving the expenditure of funds for new equipment, changes in shop and terminal layouts and for the construction of completely new shop and terminal structures. Some examples of the application of production engineering to mechanical-department maintenance work are the Glenwood wheel shop and the Cumberland flue shop of the Baltimore & Ohio and the Bluefield rip track and the Williamson engine terminal of the Norfolk & Western. These examples are not the only ones but they serve to show how the assembly-line technique can be applied profitably to railroad maintenance work.

A study of the examples cited, all of which have been described in previous issues of the *Railway Mechanical Engineer,* will show that they involve the combined use of new shop tools and equipment and changes in shop or terminal layouts and procedures. It will also show that a production principle common to all four examples is the use of the assembly-line of moving the work to the men and the tools—tools designed for production work. Particular attention is given to the flow of work and the material-handling methods and these factors are dealt with in a way that co-ordinates the operations and gears the functions of the entire facility to the production capacity of the men and the tools.

Production engineering does not necessarily deal with complete shop or terminal operations alone. It may be concerned with an individual operation that requires only the replacement of an existing tool or piece of equipment. It may also involve only a change in procedure or a rearrangement of facilities. These minor changes can make a big difference in production costs and, collectively, they will have a great influence in reducing the total maintenance cost.

It is recognized that the introduction of production tools and methods is resisted by workmen and labor organizations. Temporary dislocations are caused by the introduction of methods which increase efficiency but, in the long run, these same methods have always created more jobs than they have destroyed and are responsible for the high standard of living built up in this country. This standard can be increased only by the increase of output throughout industry and this is most effectively increased by more output per man employed. As indicated by the scarcity of examples such as those mentioned herein, there are plenty of opportunities to raise the output per man in railway shops.

Locomotive Maintenance Standards

The annual report of the I.C.C. Bureau of Locomotive Inspection for the fiscal year ended June 30, 1948, which is printed on another page in this issue, contains some interesting information and statistics, an appraisal of which should be helpful to mechanical-department men in determining future locomotive maintenance practice because it indicates where present practice is deficient.

This deficiency can be deduced from reports filed for over 37,000 steam locomotives and nearly 10,000 non-steam locomotive units, and from the inspections of approximately 94,000 and 21,000 steam and non-steam locomotives, respectively. With only four times as many steam locomotives, and only 4½ times the number of inspections, more than 11 times as many steam locomotives were found defective; over 31 times as many had defects serious enough to require withdrawal from serv-

ice, and more than 22 times as many defects were found on steam locomotives as on locomotives other than steam. All of these figures are out of line for the four times as many steam locomotives in use and for the 4½ times as many inspections made on steam power.

That these unfavorable looking ratios of defects and withdrawals from service between the two principal classes of motive power are not due to any inherent weakness of the steam locomotive, as such, has been pointed out previously in these columns. In an analysis of last year's report which had similar lopsided ratios of defects to the total inventories of the two classes of power, it was shown that the steam locomotive is not as bad as its record on paper would indicate; its rate of accidents caused by parts failures was not far out of proportion to the total inventory.

The same is true in this year's report. While there were eight times as many accidents to steam locomotives from these failures as there were to non-steam locomotives, this figure is more nearly in line with the ratios of locomotives between the two categories in service; furthermore any amount that it is out of line to a large extent can be accounted for by the large number of defects that were permitted to continue in service on the steam as compared to the other-than-steam locomotives. It must also be remembered that the four-to-one ratio between steam and non-steam power applied to units, and that it takes from two to three units to make up the average Diesel locomotive (the principal type of non-steam power) operated in road service. Therefore, when complete locomotives are considered, the preponderance of steam would be around eight to one, or numerically equal to the accident ratio.

One other thing which the reports for the past two years have in common, and which is perhaps the most important thing in common insofar as studies of comparative maintenance practice are concerned, is the accident ratio of parts which are used on both steam and non-steam locomotives. Three examples of these are the brake equipment, draft gears and air compressors. The first two of these had 13 times as many defects on steam locomotives as they had on locomotives other than steam, while air compressors had over 31 times as many defects. While none of these three parts is identical on the two categories, the design of each, and particularly of the first two, applied to either type of power is sufficiently similar to question why four times the number of steam locomotive units as of other motive power units should develop from 13 to 31 times as many defects in similar pieces of equipment.

The contention long held by many railroad men that steam locomotives could perform far more effectively if given somewhere near the attention that competing forms of motive power receive cannot be proved by figures such as the above. Such figures, however, can and do indicate strongly that the standard of steam locomotive maintenance is below that of other locomotives. They show that a case exists for better steam maintenance practice, which will result in lower operating cost.

NEW BOOKS

ELEMENTS OF MECHANICAL VIBRATION. *Second Edition. By C. R. Freberg and Emory N. Kemler. Published by John Wiley & Sons, Inc., New York. 223 pages, 6 in. by 9 in., $3.75.*

The original edition of this book, published in 1943, was developed to aid in the solution of vibration problems by the simplest and the most practical methods relying upon advanced mathematics when necessary. To the chapters of the original text have been added two new chapters that deal with sound and beams. The emphasis which engineers must give to sound elimination dictated the chapter on sound and its engineering applications. The chapter on beams adds to the data included in the previous edition.

MATHEMATICS AT WORK. *By Holbrook L. Horton. Published by The Industrial Press, 148 Lafayette st., New York 13. 196 drawings and diagrams. 728 pages, 6 in. by 9 in. Price, $6.*

This is a working manual for machine designers, tool engineers, mechanical draftsmen, technical students and teachers. The practical applications of arithmetic, algebra, geometery, trigonometry, and logarithms are illustrated by a wide variety of mechanical problems taken from actual practice. These problems are analyzed and solved in an easy-to-follow, step-by-step procedure.

Each problem is presented in such a way to show (1) what the problem is about; (2) how to analyze it and develop a method of attack and solution; (3) what formula is required, if a formula is directly applicable; (4) how this formula is derived, or if no formula is used the step-by-step procedure for solving the problem; and (5) how a typical example is worked out.

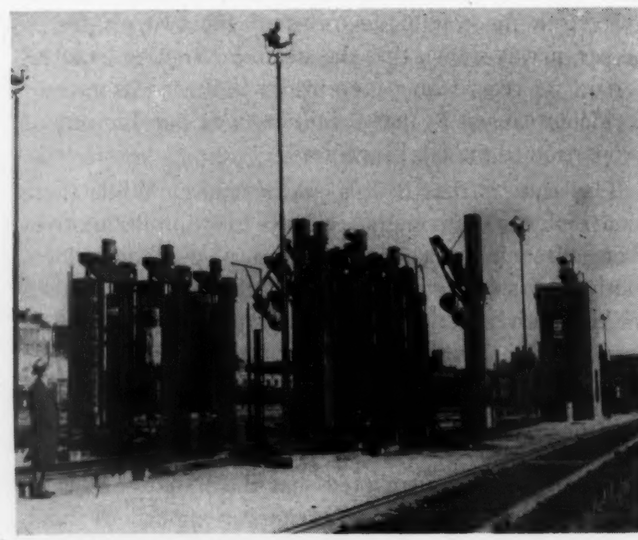
The classification of problems is mathematical; that is, problems illustrating some common mathematical principle or method have been grouped together. This classification makes it easy to find the general type of problem at hand or one closely paralleling it, hence it is possible to apply the manual to a much broader range of problems than might be at first apparent.

A five-chapter reference section gives a concise review of the practical fundamentals of arithmetic, algebra, geometry, trigonometry, and logarithms, so that where basic principles or formulas are used in the problem solutions they can be referred to if necessary.

Methods of solution that are a frequent source of difficulty have been explained in detail. The reason for using approximate formulas and the way in which they are applied is one example. The step-by-step procedure in applying trial-and-error solutions is another. The use of empirical or "working" formulas is also discussed, and a variety of problems are presented to show how such formulas are applied. A chapter on refresher questions in mathematics, mechanics, and strength of materials is included to clarify troublesome points frequently encountered in the solution of mechanical problems.

With the Car Foreman and Inspectors

Washing Passenger Cars



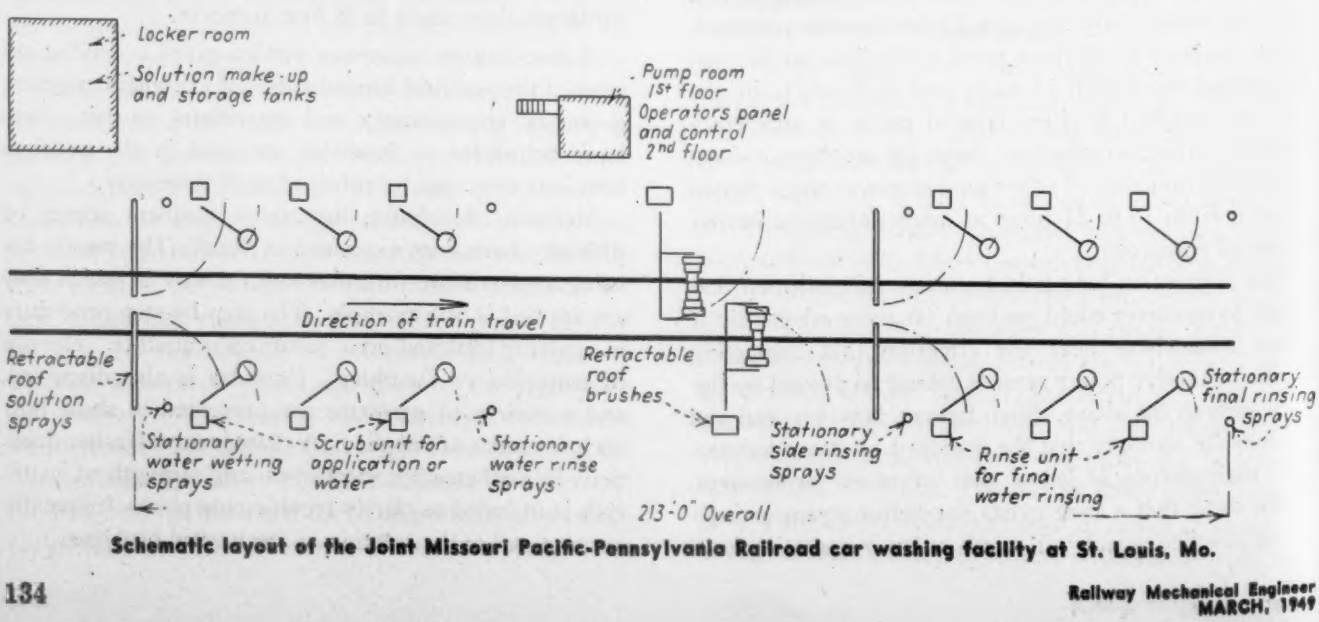
The complete car washing facility showing the solution-mixing house, the operator's control building and the scrubbing station in the background. The rinsing station, with the two roof brushes in the fully retracted position, is in the foreground

MISSOURI Pacific passenger cars are made as attractive externally as in the interior by the use of a new train washer recently installed in St. Louis, Mo., which removes the accumulated grime and dust from each car in about two minutes. Cars move at a speed of 90 ft. per min. through the washer, where they are cleaned by two sets of brushes which revolve at 240 r.p.m., and by jets of detergent and clear rinse water.

The plant is owned jointly by the Missouri Pacific and the Pennsylvania and washes more than 200 cars a day operating from 8:00 a.m. to 1:00 a.m. It is built on land leased from the Terminal Railroad Association of St. Louis, located at the throat of the yards where the two owning railroads have their separate coach facilities.

Five men are required on each shift for all train washing operations, only two of whom are engaged in the hand washing of aprons, under-car installations such as battery boxes and air-conditions mechanisms, and the ends of the cars, all of which are beyond the reach of the brushes which do the major work on the washing plant. As a car enters the facility one man tells the operator over the intercommunication public address system the degree of washing needed, whether heavy or light, and the operator gauges the amount of detergent to use. The detergent is applied through sprays, while brushes scrub the car clean. As the car proceeds to and through the rinsing station, clear water at 50-lb. pressure is sprayed on and brushes complete the rinse. The brushes, the flow of the detergent and the amount of rinse water are regulated from an operating panel located on the second floor of the control building.

The washing plant, built by the Whiting Corporation of Harvey, Ill., is equipped with loud speakers for two-



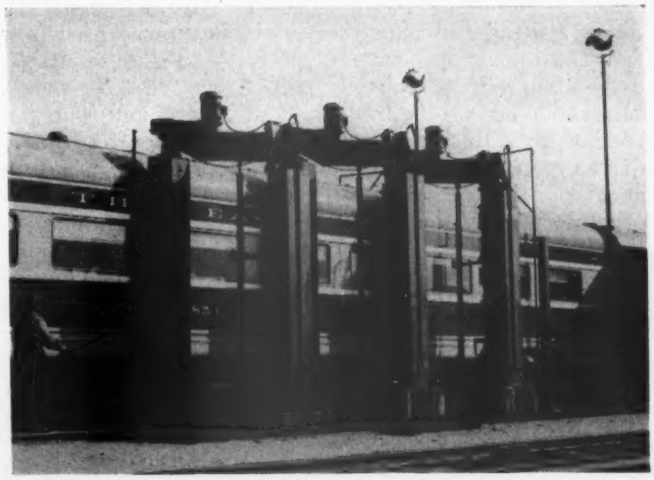
Schematic layout of the Joint Missouri Pacific-Pennsylvania Railroad car washing facility at St. Louis, Mo.

way communication from the control tower to the entrance of the plant and to the two cleaners working on each side of the train as it moves through the washer. Flood lights are mounted on tall towers for illumination at night.

The washer consists of two six-brush stations for cleaning the car sides, a set of roof brushes, and necessary wetting and rinsing sprays and controls. The overall length is 213 ft. The first six-brush station is the scrubbing unit for the car sides and windows; the second is the rinsing unit. Between them are the two retractable roof brushes. At one side of the tracks are the building for solution makeup and liquid storage tanks, and the

The operator's control panel in the elevated control house, which is located between the solution-application and the rinsing stations and affords a clear view of all the washing operations

The cantilever roof brushes normally overlap to prevent an unwashed streak through the center of the roof. A motor-driven mechanism brings the boom horizontally to and from full washing position, or to any intermediate position to permit washing roofs equipped with aerials down the center



One man on each side of the coach scrubs the skirting manually, the vestibule openings, the ends of the car and other places where the mechanical brushes do not reach

Soft-fiber Fuller brush strips set in Whiting grooved plastic cores perform the scrubbing and rinsing operation

two-story building which houses the pump room on the first floor and the operator's panel and control on the second floor. Cars are drawn through by a Diesel switcher; in passing through, the complete cleaning operation is performed by the following pieces of equipment:

1—One pair of pneumatically retractable roof spray pipe assemblies, set 6 ft. ahead of the inbound six-brush unit, applies cleaning solution to the car roofs. The solution is turned on and off by means of a 1½-in. solenoid valve controlled from the operator's station.

2—One Type S-85, one-way, six-brush electric car washer for applying cleaning solution when required, or plain water when cleaning solution is not required, to the car sides. It consists of six units, three on each side of the track. Four units have a full-length side brush 10 ft. 6 in. long and the other two are window brushes 4 ft. 6 in. long. The two pair of inbound units of this station are set 15 in. higher than the outbound pair to wash high pieces of equipment. One pair of side sprays is furnished

directly ahead and after the six single units. These four sprays are used only when using water at this station.

3—One pair of variable-height and variable-swing, retractable-boom-type roof washers for applying water to the car roofs. Each roof brush is equipped with two motor-driven mechanisms, one to actuate the brush vertically to and from the retracted to the washing position, and the other to actuate the swing of the boom horizontally to and from full washing position, or any intermediate position to facilitate washing roofs of those cars equipped with aerials through the roof center. In addition to these a double-acting air cylinder is utilized to apply pressure to the brush for washing.

The two roof brushes are staggered on 6-ft. centers but overlap, when washing a complete roof, to eliminate a streak down the center of the roof.

4—One pair of hydraulically retractible roof spray pipe assemblies for rinsing off the car roofs.

5—One Type S-85, one-way, six-brush electric car washer for applying water to the car sides for washing and rinsing. One pair of side sprays is furnished directly ahead and after the six single units, the latter being the final rinsing sprays. The brush arrangement and setting is the same in this station as in the first six-brush station described. Each brush of both six-brush stations is equipped with spray nozzles to permit water being sprayed on brushes to flush away the dirt and solution after solution is used.

All brushes revolve at 240 r.p.m. in water-sealed anti-friction bearings. Each side brush is rotated by an individual 3-hp. vertically mounted, totally enclosed, ball-bearing, squirrel-cage motor. The roof brushes are each rotated by a 3-hp. horizontal motor of the same description.

The side brushes are 18 in. diameter, filled with Tampico fiber mounted in Fuller inserts. The inserts are made in sections and mounted in Whiting compressed plastic cores. Cores are a split-type for easy removal and replacement. The successive halves of each brush are lapped or staggered with respect to each other, to prevent streaking of the car sides and roofs.

The washers are equipped with a compressed-air operating mechanism controlled by an individual double-acting cylinder for each brush to hold the brushes in the proper position for washing sides and windows of cars passing through the machine and to retract the brushes to the clear position when not in use. A restraining device is provided automatically to retract and hold the brushes in the clear posittion in case of failure of the air supply.

Each long brush is equipped with a self-aligning device to permit the brush aligning itself with the sides of leaning cars, and spray guards are provided as necessary.

Illinois Central Car Methods at Centralia, Ill.

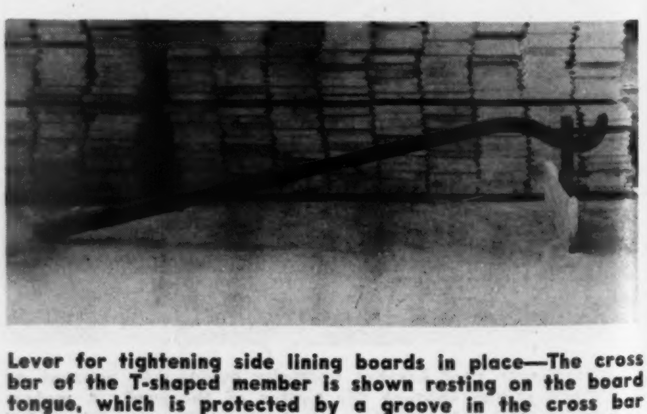
Descriptions of a group of shop devices used in the repairing and building of cars

Lever For Tightening Side Lining Boards In Place

Box car tongue-and-groove side lining boards are fitted snugly together with ease and safety but without damage to the tongue by a lever. One end of the lever has a hook which fits under the top rail while the other end is pulled down by hand to force the boards tightly together. A T-shaped member, which is connected to the lever by a bolt about 6 in. from the hook end, fits over the top lining board to compress the siding in place.

The lever is made from rectangular stock ½ in. by 1½ in. and is just under 5 ft. long, of which the last 8 in. is bent to form the hook. The T-shaped member consists of two components welded together, a cross bar 6 in. across and ¾ in. wide, and a stem made up of two 5 in. lengths of strap iron set a little over ½ in. apart and containing four ½ in. holes. The handle of the lever is held in place between the two parts of the stem by a bolt through one pair of the holes. Into the side of the cross-bar opposite the edge fastened to the stem, a groove has been cut which is a little wider and a little deeper than the width and height of the tongue on the wood. The slotted end of the crossbar fits over the wood with the tongue protected in the groove while the boards are compressed tightly together by the force applied to the T-shaped member through the pulling action on the end of the lever.

The application of the side lining is normally done in what may be considered two steps. After the first thirteen boards have been set in place, they are tightened together with two wooden tools; one fits vertically against the top rail and serves as a column support while the second is a lever which fits under the first piece of wood and squeezes the lining boards down. The remaining nine boards are then applied using the lever described above. Adjustments to compensate for small



Lever for tightening side lining boards in place—The cross bar of the T-shaped member is shown resting on the board tongue, which is protected by a groove in the cross bar slightly larger than the tongue—The five holes in the T-stem permit adjustment of the lever to accommodate varying heights of the side lining

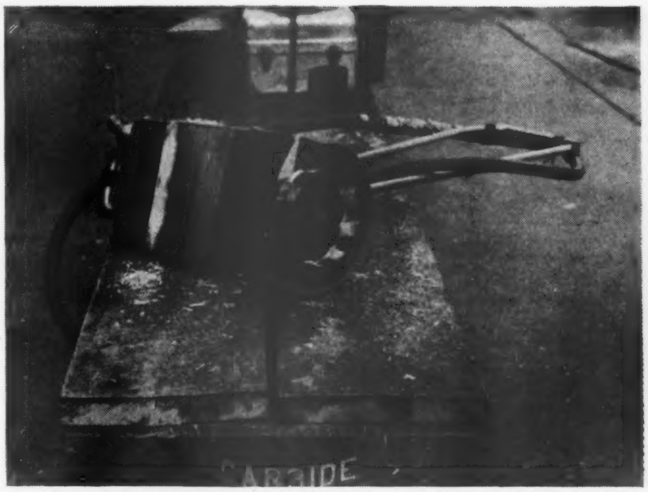
differences in the total height of the side lining are made by placing the lever handle into any one of the five pairs of holes on the stem of the T-shaped member.

Joint Between Liners and Floor Made Tight

Grain-tight joints between the bottom side lining board and the box car floor are obtained with a groove-cutting machine designed and constructed by the shop forces. The grooving machine cuts a slot equal to the width of the side lining board along the outside longitudinal edges of the floor to give the lining board a uniform seat and thereby prevent the occurrence of any gaps between the lining board and the floor.

To perform the grooving operation a strip of wood 7/8 in. by 5 in. and extending approximately half the length of the car is nailed in place parallel to the car side and about 6 in. from it. The grooving machine, which has a long handle and is operated from a working position similiar to a lawn mower, has a channel-shaped indention which fits over the board and is guided along the car side while a rotary cutter driven by an air motor forms the groove in which the bottom lining board will rest.

The milling-type cutter is 5 in. in outside diameter and approximately 1-3/4 in. thick. The cutting mechanism is mounted on a wooden block 12 in. by 8 in. by 1-1/4 in., in which a channel section has been cut and lined with light-gauge steel to fit over the guide board with a 1/8 in. clearance. The handle by which the machine is moved back and forth along the guide board is made of 3/4 in. pipe and is about 3 ft. high. It is fastened to the brackets which hold the cutter and its air motor to the mounting board. Protection to the operator from the revolving cutter is furnished by a 1/8 in. metal guard.



Close-up of the machine used for grooving the car floor to receive the bottom lining board—On the left is shown the steel-lined channel which guides the cutter parallel to the car side—On the right is the milling type wood cutter which forms the groove

Operation of the machine for grooving the floor to receive the bottom side lining board—The strip of wood, used as a guide and over which the groove of the cutter rests, is nailed in place parallel to the car side and a distance from its equal to the distance between the milling-type cutter and the near edge of the channel

The cutter is of the profile type with the width of each cutting edge equal to the width of the groove to be cut, or the thickness of the side lining board. It was made by turning to shape in a lathe and milling out the space between the teeth. The end of each tooth, or cutting blade, was then bent outward to form the cutting edge.

Underframe Turner

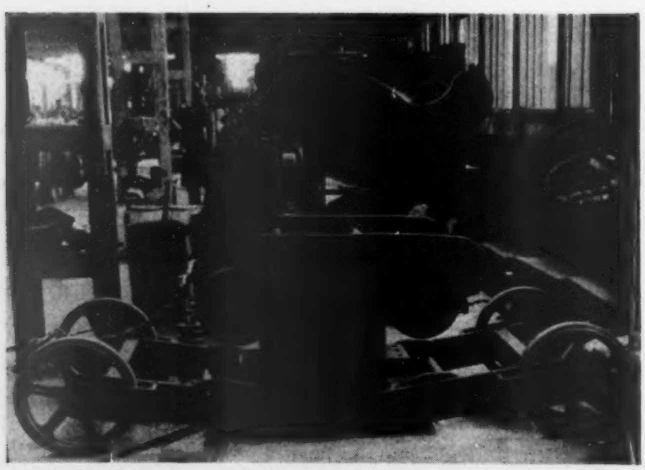
A portable machine for turning underframes over in less than one minute has been designed and built for use in their freight-car construction assembly line in which the underframes are started through the line upside down to facilitate the task of driving the rivets in the under side. When all under-side rivets have been applied, the underframe is revolved by the machine one-half turn to the normal position and placed on the trucks.

The turner consists essentially of a four-wheel undercarriage for moving the turner into position or clear of the working area as the case may be, a pair of jaws for clamping the center sill, a brake cylinder for lifting and turning the underframe, a chain which becomes taut after the underframe has been lifted high enough for the bolsters and side bearers to clear the floor for the turning operation and a stiff-leg stop which swings as the cradle rotates and levels the underframe as the piston is lowered. When not in use the device is stored alongside the position on the assembly line at which the underframe is turned and from which it is wheeled into position by hand as needed.

The machine has made possible an increase in the output of completed box cars from ten to eleven per day. It not only saves the time that would otherwise be required for arranging cables and hooks to turn the underframe by two shop cranes, which normally required about 7 minutes, but avoids as well interruptions to the cranes from other work in which they were engaged. As the box car building program calls for turning out more than one car per hour, the savings in time and interruption to the two cranes have been substantial.

In operation the turner is rolled into place and the open end of the jaws slipped over the center sill. Sufficient air is admitted through a three-way control valve to raise the piston of the air cylinder high enough to lift the underframe clear of the trucks, where it is retained temporarily to roll out the trucks on either end. More air is admitted

The underframe turner in the process of turning the underframe—At this point the underframe has been turned slightly more than one-fourth revolution



The piston in the cylinder raises the jaws vertically until the chain at the left becomes taut—At this point the left side of the jaws is restrained from rising further by the chain as the piston continues to rise, causing the jaws to make a half revolution riding on the two pairs of grooved wheels

and the underframe is flipped over. Through the control valve enough air is then bled off to set the frame back on the trucks, after which the remainder of the air is bled from the cylinder and the underframe turner rolled clear of the working area.

A.W.S. Forum On Welding Practices

Freight-Car Welding (Continued)

Q.—Is there that connection with the A.S.M.E.?

A.—We have revised the qualification so that if a man takes the guided-bend test, it will cover the A.A.R., A.S.M.E. or the Hartford Boiler regulations.

Q.—In that case, if a man is required to qualify or prove his ability to make a sound weld, shouldn't he be able to weld the safety devices?

A.—On safety devices we have had little experience. Take particularly the outlying points. We all know that to weld and do a satisfactory job, we have got to have a weldable quality of steel. Some of the small sizes—rounds, flats, etc.—used for the construction of ladders, grab irons, etc., have been bought miscellaneously, and have been around for years, so that no one knows what the materials are. You can get into difficulty, particularly with high-sulphur-content steel. When it comes to welding, in addition to all the qualifications of procedures, we still have to have a weldable material.

First of all, assume that in new construction you specify steel of weldable quality. Therefore, if you put a welded handrail on a steel of weldable quality, you expect to be able to salvage it. If the handrail is broken off you have steel of weldable quality. I think the thing ought to be started on that basis. The next factor is the qualification of operators. No one should be permitted to weld on a car in any position unless he is qualified to weld in flat, vertical and other positions, and it is more important to weld in different positions than all of these different butt weld tests. The majority of welds are fillet welds.

If the I.C.C. specifies how many inches of welding should be on a job to take care of a certain condition, and made them a definite specification with number of inches of welding, then you have all of the variables covered by specifications, all of which can be gotten from the standards of the American Welding Society. Then you have something concrete to go on. As manufacturers, we are hampered by this condition. We can't understand why you can weld a whole locomotive and cannot weld a hand rail. It is absurd. And when you say you have to rivet and weld, you haven't faith in any process.

Q.—Having qualified operators, weldable steel, and specifying the number of inches to be used in welding in particular cases, isn't your whole problem gone?

A.—As a railroad man I don't agree that you can weld a safety appliance to a car or a locomotive and be as safe as with a bolted safety appliance. Generally, a safety appliance is fastened to a strong member of a car or a locomotive, whereby if you just weld it on you come back to the same thing that was talked about a little while ago, that you weld a hand rail or grab iron to a sheet of 3/16 thickness. If you are going to replace that in the shop while working on heavy repair it may be all right but at the shop track when you have to renew a grab iron, you can't take a man out with a torch and have him burn a two-inch hole out of a sheet and then expect him to weld a grab iron.

Most of the grab irons that are badly bent on cars have to be taken off and straightened in the blacksmith shop, and we always have replacements that a man can take with him. We would have the yard full of cars if we had to wait around.

About qualification of welders—I don't know what the practice is on the other railroads but I am almost certain that almost every railroad welding operator is qualified before he is given a job as a welder. I know that we have test plates and a welder has to pass each operation of welding. Then those test plates are sent into the test department and are tested before he is allowed to make any weld on any kind of equipment on the railroad, and I am sure that all the railroads in the country are the same.

I might add that the facilities would not restrict welding on shop repair tracks because a welding machine could not always be moved to these tracks.

IN THE BACK SHOP AND ENGINEHOUSE

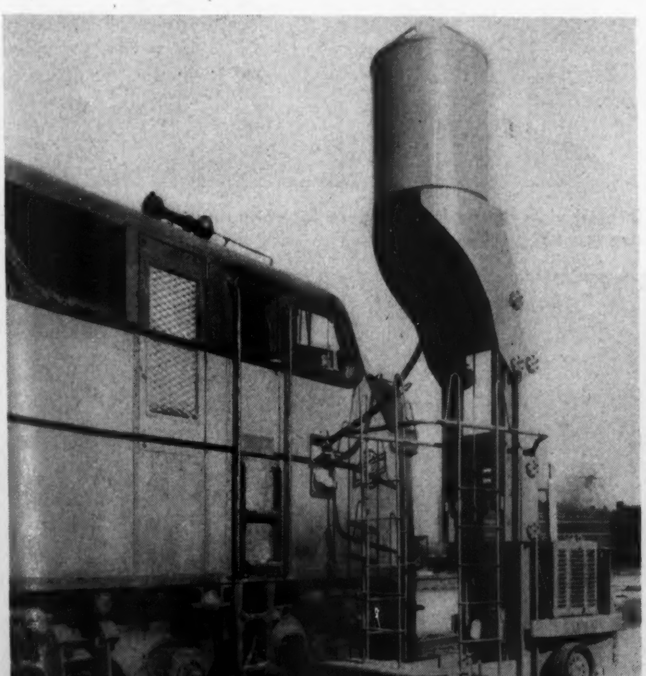
Truck For Sanding Diesel Locomotives

The Chicago & North Western has designed an adaptation of a Yale & Towne high-lift industrial truck which permits Diesel locomotives to be sanded during fueling operations and eliminates the need for locomotive spotting or movement to new locations. The truck holds 40 cu. ft. of sand and is operated over concrete runways adjacent to servicing tracks at the Northwestern's Kinzie street shops in Chicago. Radiant heating pipes are installed under the concrete to melt snow and ice, and thus to permit all-weather operations of the truck.

The truck can sand Diesel locomotives at either of two locations separated by about a quarter of a mile. One location is an existing fueling and inspection area west of the new Diesel servicing and repair shop. The second location where the truck can be used is in or east of the Diesel Shop. At either location sanding can be done during fueling if desired.

The sand is dispensed from the cone-shaped bottom of the storage tank through a hose in which it flows by gravity to the locomotive when the tank is elevated. Two control valves are installed between the truck sand tank and the locomotive. The first is a slide valve at the bottom of the cone section and the second a sleeve valve incorporated in the discharge nozzle.

The truck is loaded from an overhead sand storage tank which is located at the east end of the Diesel shop and which has two delivery hoses; one is for direct sanding of Diesel switchers and the second for delivering sand to the truck.



Sanding truck used by the Chicago & North Western for Diesel power eliminates the need for spotting locomotives and permits sanding during fueling operations. With the sand tank elevated to the position shown, or higher if necessary, the sand flows by gravity from the bottom cone of the tank through a hose and nozzle to the locomotive

The truck was modified at the suggestion and to the specifications of the Northwestern by Yale & Towne from their standard model K-25H-6M high-elevating platform truck with telescopic lift. This is a gas-electric truck with a capacity of 6,000 lb. and a maximum lift of 118 in. It has a no-load speed up to 7½ m.p.h., a full load speed to 5½ m.p.h., and a lifting speed of 26 ft. per min. Tire diameters are 20 in. at the engine end and 10½ in. at the tank end; both tire sets are 6 in. across.

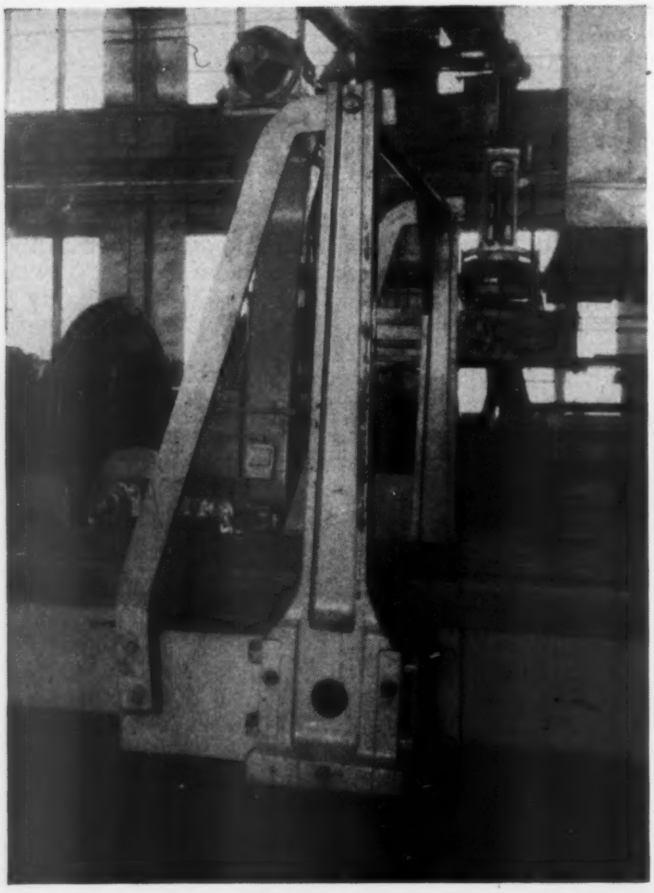
Planer Modification

Objects too large to pass between the cross-rail supports of a horizontal planer can be machined by the use of a supplementary rail support of the type constructed by the shop forces at the Union Pacific's Omaha shops. The capacity of the planer can be increased to the width needed by making the distance between the inside surfaces of the auxiliary tool-rail support equal to the clearance needed. The operation of the planer remains the same as before.

To machine a part that is too large to pass between the regular cross rail supports of the horizontal planer, the tool support rail is moved by means of an overhead crane. The tool is located at the approximate desired height by setting the rail on blocks adjacent to the supplementary rail support. While held in position on the blocks the rail is bolted to the supplementary support. The blocks are then removed, and the piece is ready to be machined.

The supplementary rail support was constructed from two scrap main rods, one on each side of the planer, each of which bolts through a filler piece to a formed section of 1-in. plate that is 2 ft. high and is in turn bolted to the planer base. This 1-in. plate is in the general shape of a channel plus a flange on the outside edge of each of the

The modified planer—In the foreground is the supplementary rail support which is set away from the planer base to give added clearance for machining large pieces



The construction of the supplementary rail support—The main vertical members are made from scrap main rods, the bottom section from 1-in. plate, and the vertical braces from 1 1/4-in. by 5-in. scrap iron

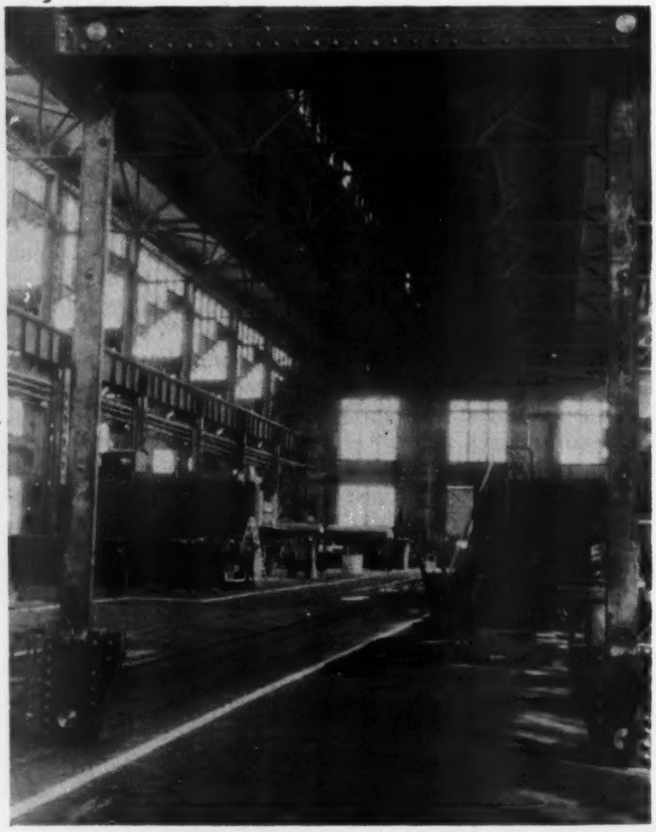
two parallel members. Through two holes in each flange the section is bolted to the planer base. The tops of the scrap main rods are joined together by a long bolt. They are braced by a section of scrap iron, 1¼ in. by 5 in., which bolts to the 1-in. plate at the bottom and is welded to the rod at the top. This brace extends across the stem of the I-section of the main rod and presents a flat surface against which the ends of a length of heavy tubing rests. The bolts which joins the rods together at the top runs through this tubing. Tightening the nut on the long bolt draws the main-rod vertical supports and the bracing sections snugly together. Additional reinforcement and rigidity is furnished by two triangular-shaped sections of 1-in. plate welded to the tubing along the top side and to the scrap main rods and the bracing along the vertical side.

Diesel-Electric Locomotive Lifters

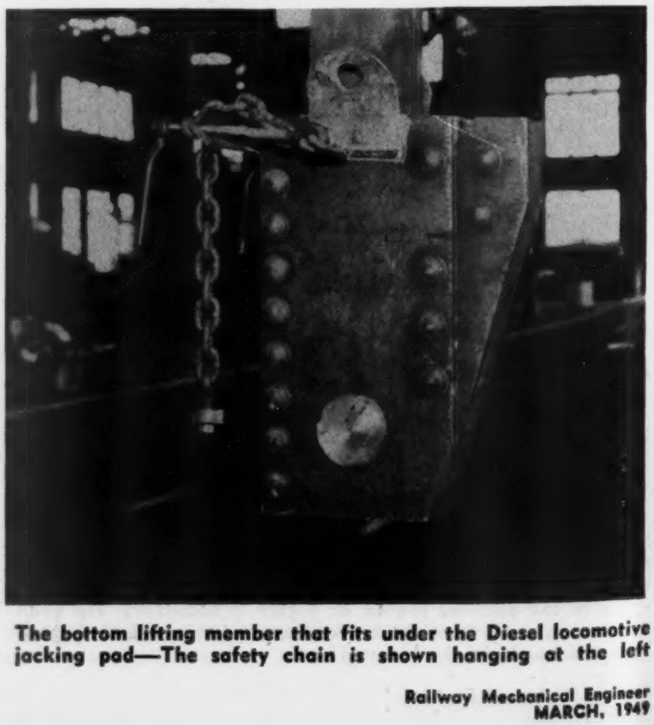
Trucks are changed on Diesel power at the Parsons, Kan., shops of the Missouri-Kansas-Texas by lifting both ends of the locomotive unit clear of the trucks with the existing back-shop crane. During the lifting operation the locomotive body is held securely by means of shop-made lifting lugs that fit under the jacking pads. Each lifting lug is on the bottom of one of the vertical links of a lifting beam and has a slot in which the jacking-pad flange fits to lock the lifting lug to the pad. As a precaution against dropping the locomotive body in the event of breaking a jacking-pad flange, the lifting lugs are prevented from sliding from under the pad by a safety chain.

The top member of the lifting assembly is a truss shape made by riveting together angles, channels and plates. It is suspended from the shop crane by two lifting ears 1¼ in. thick and 30 in. long at the base which are set in each side of the top member. The two vertical links hang from the top member and are supported by 5-in. pins. Each link is composed of five plates ¾ in. by 8 in. riveted together.

The lifting member which engages the locomotive jacking pad is secured to the bottom of each vertical link with a pin. These members are constructed by riveting together suitably shaped plates. A groove is cut in the bearing surface which the jacking pad contacts to engage the



Overall view of the lifting beam for changing out Diesel locomotive trucks



The bottom lifting member that fits under the Diesel locomotive jacking pad—The safety chain is shown hanging at the left

jacking-pad flange and thereby prevent the lifting member from slipping sideways from under the locomotive. A safety chain is incorporated in each bottom lifting member to hold the member to the locomotive in the event that the jacking-pad flange breaks. The members are lifted into place on the vertical links by two lifting ears ¼ in. by 6 in. which are welded in place.

Turntable Lock

By W. E. Abbott*

The turntable lock shown in these pictures is an I-shaped plate. For locking the table it is placed between the rails of the table track and approach track with the ends of the I spanning the joint. To unlock the table, the locking bar is moved onto the table.

Formerly, the lock was moved with a hooked rod. The person moving it had to stand between the rails in a dangerous position. To eliminate this practice, the parts shown were attached so that the lock is now operated from a safe position. A piece of 1-in. pipe, welded to the bar at right angles, is moved back and forth by means of two steel cables run through pulleys mounted on the table. The cables, in turn, are attached to a bell crank which is moved back and forth by a lever attached to the side of the turntable cab. Movement of the lever thus pushes the locking bar between the rails or pulls it out onto the end of the table.

Material used included two pulleys for 5/16-in. rope. 5/16-in. tiller rope in suitable lengths. ½-in. round iron in suitable lengths, two 5-ft. lengths of 1-in. iron pipe, one 4-ft. length of 1¼-in. conduit, and two short lengths of the same size conduit, with the necessary guides and brackets.

A 60-in. length of 1-in. iron pipe is welded at one end to a ½-in. iron plate which in turn is welded to the lock. The iron pipe runs back through a guide where one of the pulleys is also attached, and on through a second guide near which the second pulley is attached.

*New York Central, North Bergen, N.J.

Turntable operator locking the table

The I-shaped bar used to lock the table and the pipe, pulleys, cable and pull-rods used to move it

The two lengths of tiller rope are both attached to the 1-in. pipe halfway between the two pulleys, which are 24 in. apart. Each of the tiller ropes are run through a pulley and attached to two lengths of the ½-in. rods which pass through holes provided in the rail. Two more lengths of ½-in. rods join the first two, and are run under the walk, where they hook into their respective ends of a fork of flat iron. This fork is connected to the bottom end of the second 60-in. length of 1-in. iron pipe which serves as a shaft and runs up through the 1¼-in. conduit. At the top end of the 1-in. pipe, the 24-in. handle is attached.

The 1¼-in. conduit serves as a column for the 1-in. pipe and the conduit is attached to the turntable house by two brackets.

The ½-in. iron rods were used through the rail and under the walk instead of the tiller rope because of chafing. The rods were made as links because of the side motion caused by the movement of the fork, or bell crank.

The lock is limited to about 8 in. of travel each way by the use of the two stops.

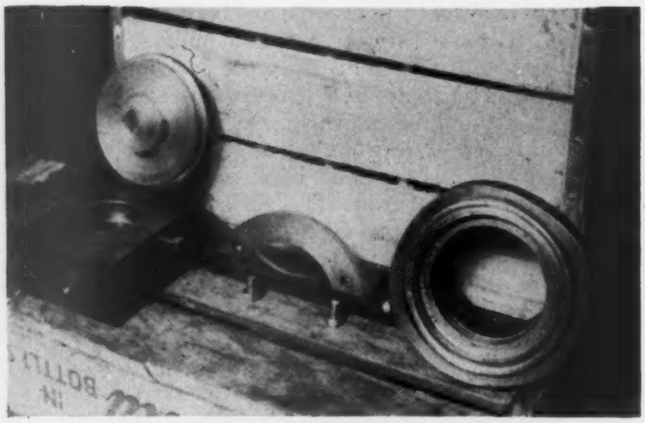
Machining Spring Hanger Buttons and Clips

Spring-hanger buttons and clips are machined easily, quickly and accurately, and the oil grooves cut, with the aid of three jigs at the Texas & Pacific, Marshall, Tex., shops. The jigs include a holding fixture for machining the spherical surface of the button, a holding fixture for the button for cutting the oil grooves, and a two-piece template for machining the convex surface of the button and the concave surface of the clip.

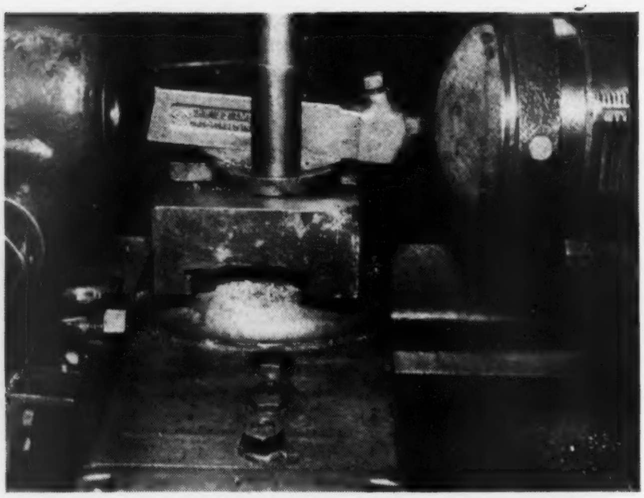
After a button has been faced on the flat side it is set in a round holding chuck which has an inside split brass ring and an outer holding ring with two set screws set opposite to each other to compress the chuck on the button. The concave portion of the two-piece template is bolted to the bottom of the tail stock with two ⅜-in. bolts for generating the convex spherical surface of the button, and the follower is screwed into the base of the cross-compound feed of the lathe. The brass holding fixture with the button in place is chucked in the lathe and a ¼-in. hole drilled in the center of the rough cast spherical surface. The concave surface of the template is oiled and the follower pointer placed in the template center. The button surface is machined from the center outward, enough cuts being taken to make the distance from the flat surface to the end of the spherical face ½ in. The button is then removed from the machine and from the holding fixture and placed in a second holding fixture. This fixture turns between the lathe centers and holds the button for cutting the oil grooves on the spherical surface.

The spring hanger clips are chucked in the lathe jaws. After a ¼-in. hole has been drilled in the center of the clip, the convex portion of the template is bolted to the concave portion. With the follower held firmly against the convex template the concave surface of the clip is machined.

The holding fixture for the button is made from a solid brass ring threaded to receive two set screws and an internal holding ring which is in two semi-circular pieces. The block for holding the button while cutting the oil groove is 5⅜ in. by 4¼ in. by 2⅜ in. An opening is bored out of the center to receive the round projection of the button, which is held by tightening a set screw against this shoulder. One end of this holding fixture



The three jigs used in the manufacture of spring-hanger buttons and clips—From left to right is the holding fixture for cutting the oil grooves, the templates for generating the concave and convex surfaces of the clip and button, and the brass fixture that holds the button while the convex surface is being machined



Machining the convex surface of the spring-hanger button—The button is in the holding fixture which is held in the lathe chuck—On the lower left is the concave shaped portion of the template which guides the cross-compound feed and the cutting tool through the desired path of travel in machining the button

is held in the lathe chuck. The other end has a hole in which fits the tail stock; this hole is 1-9/16 in. below the face in which the opening to receive the button is bored. As the lathe turns this holding fixture the spherical convex surface of the button is turned in a circular path and the oil groove cut.

The concave-shaped template used for generating the spherical convex surface on the button has a cross sectional area equal to that of an angle ¼ in. by 1½ in. by 1½ in. Each surface is perpendicular to the other. In the flange there are two ⅜-in. holes to bolt the template to the tail stock. A follower opening machined in the horizontal portion causes the tail stock and the turning tool to follow a similar path. The convex portion of the template which generates the concave surface of the clip is bolted over to the concave-shaped part of the template. This guides the follower mounted on the cross-compound feed in the same manner as the concave-shaped portion of the template and causes the tool to generate the concave surface of the clip.

Questions and Answers on Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address of the writer, whose identity will not be disclosed without permission to do so.)

Track Curvature

Q.—What is the maximum curve that a six-wheel switcher can be expected to negotiate successfully? The locomotive is not equipped with a lateral motion device and all tires are flanged.—R.E.K.

A.—The maximum curve that a six-wheel switcher will negotiate would be dependent on the length of the rigid wheel base.

	Maximum rigid wheel base, ft.-in.	
Curvature, deg.	6-Coupled	8-Coupled
16	15—6	16—6
17	15—0	16—0
18	14—6	15—6
19	14—0	15—0
20	14—0	14—6
21	13—6	14—0
22	13—0	14—0
23	13—0	13—6
24	12—6	13—6
25	12—6	13—0

The table shows the curvature for the maximum rigid wheel base (all tires flanged) based on one-inch total clearance, as given in "The Steam Locomotive" by Ralph P. Johnson.

The one-inch total clearance includes widening of gage, flange play, hub play and other conditions not definitely known. The maximum figures given in this table may be exceeded when there is full information as to the tire setting, widening of gage, etc.; but for the general run of work where these factors are known, the table will be useful.

Frame Design

Q.—We have considerable trouble with the frames of our Mikado type locomotives breaking at the main pedestal. The locomotives have the conventional two-rail cast-steel frames and I am wondering if the cross-sectional area of the frames at the top of the pedestal opening is sufficient as compared to the total cross-sectional area of the top and bottom rails between the pedestals. Certainly the pedestal binder cannot be considered as a bottom rail, as I have been told.—R.O.V.

A.—The approximate rules for proportioning cast-steel frames as given by the locomotive builders are as follows:

$$S = \frac{T}{C},$$

where
S = Sectional area of frame, sq. in.
T = Piston thrust (piston area x boiler pressure)

C = Constant (see table)

	C: From cylinders to main pedestal, including top rail over main pedestal	C: Back of main pedestal
Top of pedestals	2,500-2,700	2,900-3,200
Top rail between pedestals	3,000-3,200	3,500-3,800
Lower rail between pedestals	4,300-4,500	5,100-5,300
Integral single rail at back of cylinder keying lug	1,600-1,800	

This method gives sectional areas back of main pedestal approximately 15 per cent less than similar areas at or ahead of main pedestal. The depth of the top rail ahead of front pedestals must not be less than that of top rail over front pedestals.

Factor of Adhesion

Q.—The factor of adhesion for a steam locomotive is generally taken to be the weight on drivers divided by the tractive effort, and is generally accepted as 4. Is it possible to have a factor of adhesion as high as 5 or 6?—R.K.L.

A.—The factor of adhesion of a reciprocating steam locomotive is generally taken as the weight on drivers divided by the rated tractive effort and is usually about 4, although in many cases it varies slightly above or below this figure.

The value of the factor of adhesion depends on the conditions of the rail and can possibly get as high as 5 or 6 for a locomotive rated at 4. The following values are generally accepted—6.66 for greasy, moist rail; 5 for clean dry rail with chilled-iron wheels; 4 for clean dry rail with rolled-steel wheels, or well sanded rail with chilled-iron wheels; 3.33 for clean dry rail, well sanded, with rolled-steel wheels.

Thus a locomotive, having a factor of adhesion of 4 or a tractive force of 25 per cent of the weight on drivers on a clean dry rail, would have a factor of adhesion of 6.66 or a tractive force of only 15 per cent of the weight on drivers when on a greasy, moist rail.

Locomotive Boiler Questions and Answers

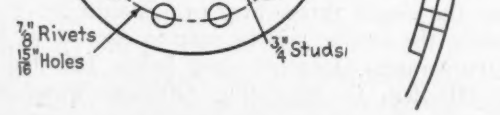
By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Patch Efficiency

Q.—Attached is a reinforcement patch for a 2¾-in. diameter boiler check hole. Would you please advise, through your department in the *Railway Mechanical Engineer*, the efficiency of this patch.—W.W.S.

A.—The reinforcement patch for a 2¾-in. diameter boiler check hole, submitted with the question, is shown in the accompanying illustration. This liner can fail:



Patch for boiler check

(1)—along line A-A-A by the tearing of the plate between check hole, stud holes and outside rivet holes, plus shearing of five rivets in single shear in outside row; (2)—along line A-B-A by the tearing of the plate between check hole and three stud holes, plus shearing of five rivets in single shear in outside row and (3)—along the outside row of rivets by the tearing of plate between rivets in outside row.

The efficiency along line A-A-A is:

$$[6.025 - 2.875 + 2 \times 2.25 - (2 \times .75 + .9375)] \times \frac{55{,}000 + 5 \times .6903 \times 44{,}000}{9.6875 \times 55{,}000}$$

$$= \frac{286{,}687 + 151{,}866}{532{,}812} = .823 \text{ or } 82.3 \text{ per cent}$$

Along line A-B-A the efficiency is:

The circumference of a 6 1/16-in. diameter circle = 19 in.

$$19 \div 6 = 3.166 \text{ in. rivet spacing}$$

$$[(2 \times 2.25) + (2 \times 3.166) - (3 \times .75) + .9375] \times \frac{55{,}000 + 5 \times .6903 \times 44{,}000}{9{,}6875 \times 55{,}000}$$

$$= \frac{420{,}447 + 151{,}866}{532{,}812}$$

$$= \frac{572{,}313}{532{,}812} = 1.074 = 107.4 \text{ per cent}$$

Along the outside row of rivets the efficiency is:

Circumference of 10-in. circle = 31.416 in.

$$31.416 \div 12 = 2.618 \text{ in. rivet spacing}$$

$$\frac{[5 \times 2.618 - 5 \times .9375] \times 55{,}000}{9.6875 \times 55{,}000}$$

$$= \frac{462{,}137}{532{,}812} = .8673 \text{ or } 86.73 \text{ per cent}$$

The efficiency of the reinforcement liner would be 82.3 per cent. The efficiency of this reinforcement would have been greatly improved had it been made, using a diagonal-shaped reinforcement liner, thus obtaining more rivets in shear and also improving the efficiency in the outside row.

Manual Blow-Down

Q.—We are equipping locomotives with manual blow-down system with the blow-off cock located at the back corner of the mud ring. If the system has a perforated pipe, connected to the blow-off cock and extending across the back of the mud ring, should the holes in the pipe be of uniform size?—R. E. V.

A.—The purpose of the perforated pipe across the back of the firebox ring is to provide a suction to remove the deposits on top of the mud ring. It is the practice of some railroads to drill the holes in the pipe a uniform size while on other railroads holes of different sizes are drilled into the pipe, increasing the size uniformly with the distance from the blow-off cock to provide the same suction from the right half of the back mud ring as from the left side near the blow-off cock. The theory behind the drilling of the holes, increasing the size uniformly as the distance away from the blow-off increases, is no doubt correct, but for all practical purposes a pipe drilled with uniform size holes of sufficient size as not to plug up should be satisfactory.

Diesel Locomotive Questions and Answers

By J. R. Benedict

WATER COOLING SYSTEM—G.M. ENGINES

Q.—How are cracked engine parts located?

A.—Cracked engine parts will permit water to leak into the lubricating oil system or air box. A cracked cylinder stud well will permit water to go up through head stud hole onto the top deck of engine into the lubricating oil. Other engine parts which, if cracked, will permit water to flow into the lubricating oil are: Cracked cylinder liner at its bottom, cracked top of cylinder head, crack in oil-cooler radiator, cracked crankcase, cracked cylinder liner on outside. A cracked head (usually at exhaust valve ports) will permit water to enter the cylinder liner. [Note: Before applying any gaskets or rubber seals, extreme caution must be exercised that gasket or seal seat is clean and free from nicks or burrs, also all rubber seals must be straight and not twisted in any manner.]

Q.—What causes high water temperature?

A.—High water temperatures will be due to either an insufficient volume of water in the system, poor circulation or improper functioning of cooling fans and shutters or a combination of the three.

Q.—How is an insufficient volume of water determined and how is it corrected?

A.—Water level should be at high level or full glass for summer operation and low level (G valve) for winter operation. On F3 locomotives, water should be at G-valve level with engine shut down, during all seasons. Water level should never be below the A valve or out-of-sight glass under any conditions on 12-cylinder engines, or below one-half glass on 16-cylinder engines, and on F3 not below 1½ in. in the lower glass under any conditions. When the water level is below the above listings, the engine temperature switch may not be submerged in water and would show a low temperature reading although the engine temperature is dangerously high. Serious damage may result if the engine is operated under full load with no water in its system. However, should an occasion arise when the water level drops below any visual observation point or even if all the water should be lost from the system, the engine must not be stopped. Permit the engine to operate at idle speed and refill very, very slowly.

Q.—What causes poor circulation and how is it remedied?

A.—Poor circulation of water throughout the system will cause high temperatures. The water pumps have the capacity to circulate all the water through the engine approximately each 30 seconds. Water circulation may be checked by water-pump pressure-gauge reading located on the water pump outlet elbow, and should read, when normal, between 20 and 30 lb. at full throttle and 5 to 8 lb. at idle. A high water-pump pressure-gauge reading will usually indicate defective pumps or clogged up cooling-water radiator passages. Foreign objects such as rust, dirt, pieces of rubber hose, etc., circulating through the system will usually collect at the radiator headers, thus preventing adequate circulation of water through the radiator cores. However, some locomotives (F3 for example) have in the first radiator header a wire screen which will collect this foreign matter and, if so equipped, these screens should be cleaned on a routine maintenance schedule. For line of road operation, should water pump pressure be high or low, the Diesel engine may be safely operated as long as an adequate supply of water remains in the system and water temperature is maintained at proper level.

Q.—How is the improper functioning of cooling fans and shutters handled?

A.—The engine water temperature should be kept at 165 deg. F., plus or minus 15 deg. These readings are given as temperature ranges only, and temperature must be maintained at a constant level as a sudden increase or decrease of water temperature will result in contraction and expansion of engine parts, which will result in damage to the engine. Water temperature is maintained by means of shutters and cooling fans. Cooling fans on 12-cylinder engines operate constantly and vary their speed with engine speed, temperature therefore, is controlled by shutter operation only. On FT class locomotives, two sets of cooling fans are used (in conjunction with the shutters), and are driven by a speed increaser which must be engaged only when the engine is at idle speed. On this type locomotive, the cooling fans on the rear or generator end of the engine should be operated in preference to fans at the front of engine, as they assist in the cooling of the electrical equipment. Cooling fans are driven by belts which should always be checked for splitting, looseness or signs of excessive wear. For line of road operation, if a belt is found defective, it must be removed at once as, should the belt break, it will probably break the remaining belts also. Should the speed-increaser clutch be slipping, it may be kept operating by tying or blocking the clutch throw arm in. Should the fans fail completely, the engine will be safe to operate as long as water temperature does not drop below 125 deg. F. or exceed 210 deg. F., providing sufficient water level is maintained in the system. On locomotives equipped with automatic shutters other than F3, should the shutters fail to operate properly, check for thermostat bulb being broken or dirty, a kinked or broken capillary tube and the operation and electric contacts of the shutter relay and shutter magnet valve.

For line of road operation, these shutters may be operated manually. On F3 locomotives, a thermostat switch located on water pipe from outlet manifold of engine

operates in such a manner so as to close its contacts, which will energize a circuit to operate the shutters and energize *AC1, AC2, AC3, AC4* relays, causing four 12-hp. motors to operate the cooling fans. For line of road operation, should this electrical equipment fail and shutters fail to open, sufficient air for cooling may be obtained by opening the engine room doors and windows. If cooling fan relays fail, move summer-winter switch to opposite position, as on some locomotives this will change the cooling-fan operating sequence and perhaps two of the fans will operate. If this fails, operate the engine only as long as the temperature remains within safe limits as listed above.

During freezing weather, it will be necessary to drain the water systems of all Diesel locomotives other than F3 to the winter G-valve level in order that no water will be stored in the radiators, thus preventing their freezing. If steam is admitted to the water cooling system, care must be exercised that water level does not go above G-valve level. On freight locomotives so equipped, when steam is admitted to the water system, the steam condensate J-valve must be left open in order to return steam condensate to boiler water storage tank. (When boiler is not operating, radiator hatch cover should be removed to permit warm air coming from the water radiators to enter the engine room to prevent boiler water storage tank from freezing.) Should it be necessary to drain the water from a 12-cylinder engine, open A, B, C and G valves and remove water pump drain plugs. On 16-cylinder engines FT, open E, G and H valves, remove water pump drain plugs and cab-heated plugs.

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

Automatic Valve Release Position

(*Continued*)

777—*Q.—In what position is the controlled emergency piston with the rotair valve in freight position?* A.—In the upward or controlled emergency position.

778—*Q.—How is this accomplished?* A.—In freight (FRGT) position, of the rotair valve, main reservoir air flows through the rotary valve (*15*) to pipe *35*, thence to passage *35* of the *D-24* control valve and chamber *B* of the controlled emergency portion, forcing the piston upward, seating large piston *187*, and unseating small piston *185*.

779—*Q.—How does this complete the connection for controlled emergency?* A.—Air from passage *3-H* can flow past unseated piston *185* to chamber *D* and seat diaphragm valve *199*, which provides for a controlled build-up brake cylinder pressure during an emergency application.

780—*Q.—What connections are made with the rotair valve in passenger position?* A.—Passage *35* is connected to atmosphere, so that chamber *B* is vented and the controlled emergency piston is moved down, seating small piston *185* and unseating the large piston.

781—*Q.—How does this set-up affect the flow of air in emergency position?* A.—Air from passage *3h* cannot flow past piston *185* to chamber *D*, so that diaphragm valve *199* is moved and held to the left by a spring. Air from passage *3a* can flow unrestricted to passage *3* to apply the brake.

782—*Q.—What pressure is flowing to the relay valve?* A.—Main reservoir air flows through choke *12* to the spring chamber back of the application piston valve.

783—*Q.—What is the position of the relay valve at this time?* A.—In release position.

784—*Q.—Explain how this is accomplished.* A.—With brakes released there is no pressure in the displacement reservoir or control pipe, nor in the chamber in front of the relay piston. This piston is therefore in release position, the exhaust valve and piston being in open position (down), opening brake cylinder air to the exhaust.

Running Position

785—*Q.—In this position, what port from the main reservoir is cut off?* A.—Main reservoir passage *30* is disconnected from the warning port. Thus the warning signal is cut off in running position.

786—*Q.—How is control chamber* G *in the feed valve connected in running position?* A.—Passage from the control chamber (*32*) is cut off from passage *43* and is connected to passage *2* through cavity E and passage *2a*. Thus the brake pipe air from passage *2* is connected to the feed valve control chamber *G* at all times in running position.

787—*Q.—What connections are made with feed valve air from chamber A over the rotary valve?* A.—Feed valve air from chamber *A* is supplied to passages *2* and *4* and also to passages *14* and *22*.

788—*Q.—To what is passage* 14 *connected?* A.—To passage *14a* and the top of maintaining valve *87* which is held seated by spring *88*.

789—*Q.—How is passage* 22 *connected?* A.—To passage *14a* and the top of maintaining valve *87* which is held seated by spring *88*.

789—*Q.—How is passage* 22 *connected?* A.—Passage *22* is connected to passage *23*, connecting feed valve air to the rotair valve.

790—*Q.—How does the feed valve air flow through the rotair valve in freight position?* A.—Through passage *33* to charge the first suppression reservoir.

791—*Q.—How does it flow with the rotair valve in passenger position?* A.—In passenger position passage *33* is disconnected from passage *23*.

792—*Q.—In this position is the flow of air the same as in release position?* A.—The same as in release position except as follows: Return spring *109* moves spring cage *108*, and service piston and graduating valve back to normal release.

793—*Q.—Does this change the charging connection, as compared to release position?* A.—No, except that the service piston seal is opened, permitting charging of brake pipe air from chamber *A* through port *83a*, passage *5e*, and piston seal to chamber *C*.

794—*Q.—Describe the flow of air in the emergency portion in running position?* A.—Return spring *65* returns cage *64* to the left, moving piston, slide and graduating valves to release position.

795—*Q.—Are the port connections the same as in initial charging?* A.—The same except that slide valve cavity *s* is moved to the left and cuts off connection between passage *3h* and *17* from passage *19*.

ELECTRICAL SECTION

Twenty-Five Years Progress in

Traction Motor Design*

By M. J. Baldwin †

Traction motors must bear the brunt of hard service on Diesel locomotives and a thorough understanding of their characteristics and requirements is a must for satisfactory operation

Although the traction motor at some 60 years of age is one of the oldest in the electrical industry, nevertheless it is a thriving oldster with an annual output of approximately 2.5 million horsepower which has, in the past quarter of a century, staged a decided comeback due to the rapid development of the Diesel-electric locomotive.

Design Objectives

Traction motors are designed primarily for minimum weight. This is particularly true for trolley cars and coaches where weight is at a premium. For Diesel-electric

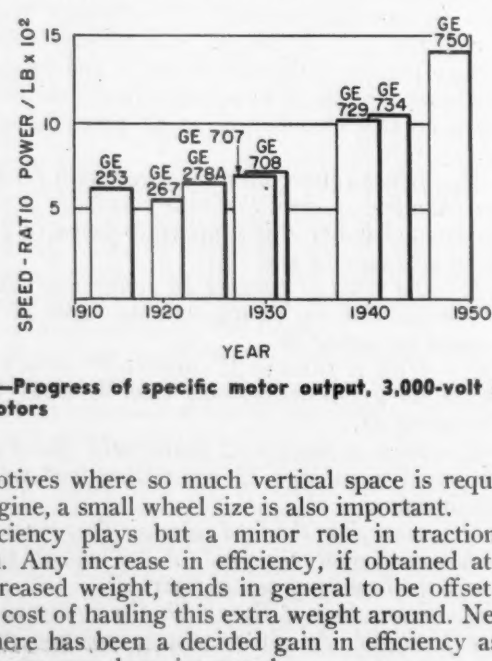


Fig. 1—Progress of specific motor output, 3,000-volt locomotive motors

locomotives where so much vertical space is required by the engine, a small wheel size is also important.

Efficiency plays but a minor role in traction-motor design. Any increase in efficiency, if obtained at a cost of increased weight, tends in general to be offset by the added cost of hauling this extra weight around. Nevertheless there has been a decided gain in efficiency as speed and horsepower have increased.

Comparing Motors

Two factors are of primary importance in measuring the application capacity of a traction motor: (1) continuous rated horsepower and (2) the ratio of maximum permissible to rated speed. The first factor, rated horsepower, requires no comment since this is generally accepted as the primary, if not the only, measuring unit. The traction motor, however, must be rated at a relatively low speed; and it must also be capable of operating at maximum permissible speeds ranging from 2 to 5 times its rated speed. The product of the two factors: ratio of maximum to rated speed, and the rated horsepower is called "speed-ratio power" and is used to compare, in Figs. 1 to 6 inclusive, the advances made over the years in various lines of motors. Gains range from 70 to 300 per cent depending upon the application.

Speed-ratio power is an accurate measure if used to compare motors that are not too widely apart in peripheral speed at the rating. In each case, the comparisons here made are for a given class of service, and the error due to differences in peripheral speed is estimated to be not over 5 per cent.

Advances in the design of a motor as old and established as the traction motor are arrived at generally in such small steps that it is not until the history over a relatively long period of time is reviewed, that the overall progress can be appreciated.

Anti-Friction Armature Bearings

The first significant change that took place during the past 25 years was that from the waste-packed sleeve to the anti-friction type of armature bearing. Reduction in friction due to the "anti-friction" feature was incidental although there is no doubt some slight reduction in torque loss on an initial cold start. The anti-friction bearing, however, does have three advantages over the sleeve: it operates at high speed with simple and reliable lubrication, it

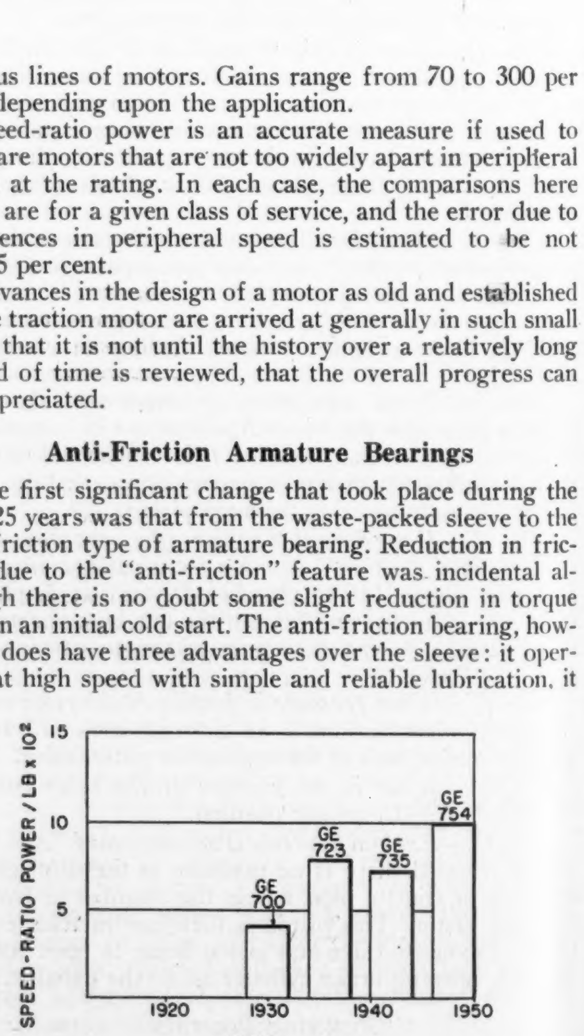
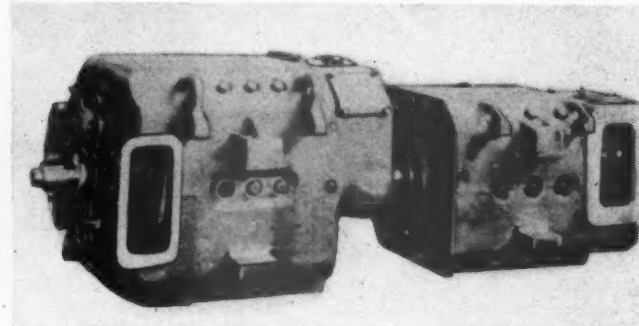


Fig. 2—Progress in specific motor output, 3,000-volt multiple unit car motors

*Abstract of a paper presented at the A. I. E. E. winter general meeting, New York, N. Y., January 31-February 4, 1949.
†Motor Engineering Division, General Electric Company, Erie, Pa.



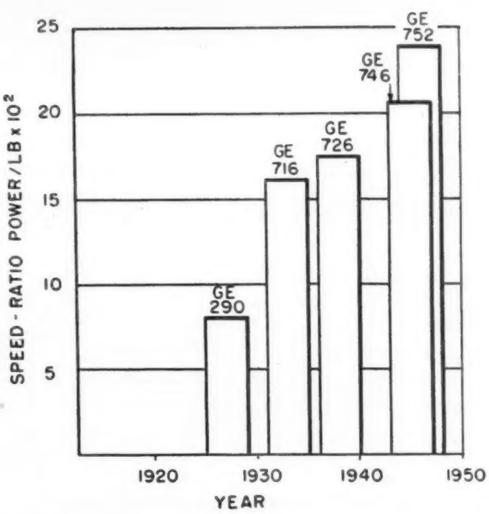


Fig. 3—Progress in specific motor output, internal-power road locomotives

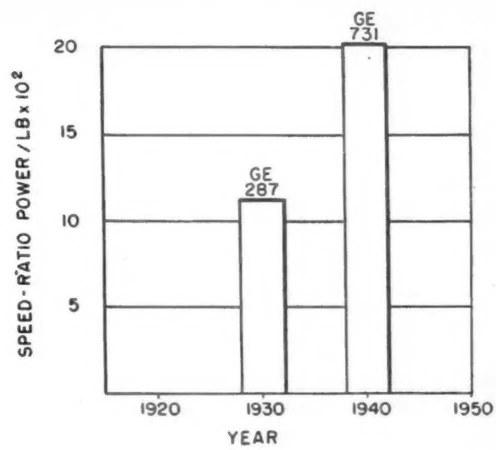


Fig. 4—Progress in specific motor output, internal-power heavy switching locomotives

requires less axial space allowing room for increased active material, and the negligible wear with which it operates makes possible better maintenance of gear centers.

The principal problem in connection with the use of anti-friction armature bearings has been to keep the lubricant in and dirt and water out. The solution has been fairly well worked out for grease. Oil is an ideal lubricant for anti-friction bearings and very little is required in the bearing at any time. Leakage and vaporization make it difficult to confine and means must be provided to continually replace that which is lost. Where oil is the gear lubricant, it is possible to obtain an adequate supply for the pinion-end bearing from the gear case. In this instance, however, general practice is followed in that the commutator-end bearing is grease lubricated.

Gearing

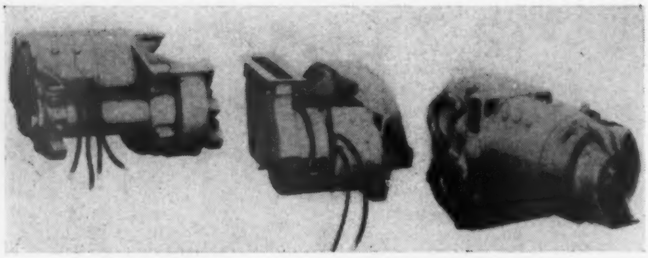
On large-size traction motors at the beginning of this 25-year period, twin gearing usually was used. Two gears, pinions and gear cases were required, one pinion being mounted on each end of the armature shaft, and one gear being mounted on the locomotive axle or wheel hub at each end of the motor. Equalization of gear loading was obtained by the use of springs between the rim and the center of each gear, tangential motion being permitted between the two parts in these "spring" or "cushion" type gears. About 20 years ago, twin gearing of this type was replaced by single gearing using solid gear, pinion and gear cover. This change gained added space axially for active material in the motor core and effected an appreciable cost reduction.

Elimination of the second set of gears was in part made possible as a result of the better gear center distance maintenance resulting from the use of anti-friction armature bearings, as has been noted; but there also were improvements made in the fundamental design of the gears and pinions. The gearing of the older twin-geared motor was cut and heat-treated, but left relatively soft to permit wear in service to equalize cutting variations in the teeth and the tooth spacing. With the development of equipment for grinding tooth profiles after heat treatment, a harder, stronger gear material was used. The pressure angle of the teeth was increased to obtain more strength in binding. The two small fillets and short tangential section connecting adjacent teeth were changed to a single long radius fillet to minimize stress concentration in the pinion hub and gear rim. The grinding of the profiles improved the division of load on the teeth and minimized the torsional stresses in the armature shaft caused, particularly at high speed, by variation in spacing of the teeth.

Another popular way of obtaining high gear reduction is by making the pinion integral with a short shaft supported by bearings adjacent to the pinion on both sides. This so-called "straddle-mounted" pinion can be made unusually small. Its use has been found practical where the gear unit is separate from the motor as is the case for truck or bodymounted motors used on P.C.C. cars, trolley coaches and at least one of the most recent medium-sized traction motors.

Double-Reduction Motors

In the past ten years, the double-reduction traction motor has come into widespread use for internally-powered locomotives operated principally in switching service. Motors of the general type shown at the right in Fig. 5 have two reductions: the high speed being of the spur type, and the low speed being a hypoid. All bearings in the case, the pinion-end armature bearing and also the axle linings are lubricated from the same oil bath. Only



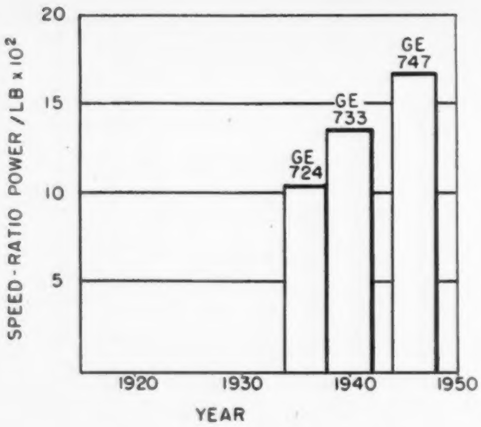


Fig. 5—Progress in specific motor output, internal-power light switching locomotives (double-reduction gearing)

the commutator-end bearing of the motor is separately lubricated with grease.

Commutators

Increases in armature speed have been made possible largely as a result of corresponding improvements in commutators. On all high-speed motors, particularly those used in road service, the commutators are spun. This is the word generally used to designate the curing process. It consists of an indeterminate number of cycles of heating while revolving at high speed, cooling and tightening, which are repeated until a commutator surface is obtained that is smooth and relatively unaffected by variations in either speed or temperature. This process is expensive, but at present appears necessary to obtain commutators which are good for the maximum operating speed of approximately 10,000 ft. per minute, currently used for most railway motors. Increasing use of commutator spinning has been made from about 1925.

Instead of the usual vee-bound commutator, a few of the most recent motors have been equipped with arch-bound commutators. In this type, the retaining vee-shaped sections of the cap and shell serve only as retractors to draw the bars in toward the center of the commutator and thereby build up tangential or "arch" pressure between the segments. In the so-called vee-bound type, the bars are clamped axially between the vee-shaped sections without developing high pressure between the bars. Of the two types, the arch-bound commutator generally has a somewhat better surface and requires less spinning.

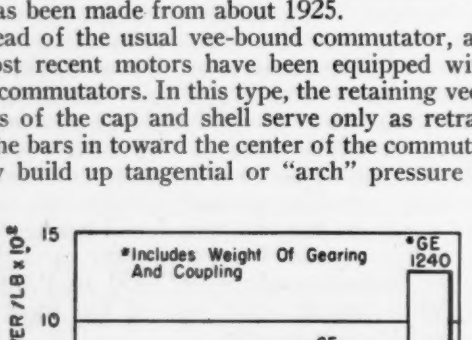


Fig. 6—Progress in specific motor output, 600-volt multiple-unit car motors

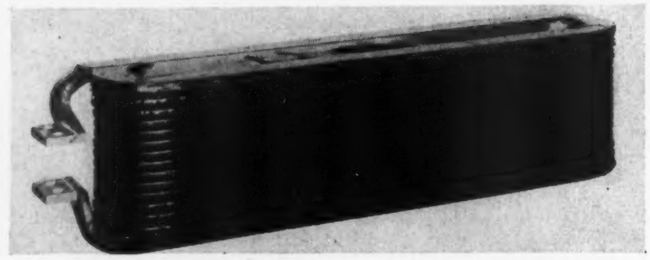


Fig. 7—Commutating field coil for motor used in internal-power locomotives

Brushes

Along with improvements made in commutators there have been complementary improvements made in brushes. Brushes having a porous surface have been developed that are sufficiently non-resilient to follow the minute variation in the surface of commutators. Extensive use has been made during the past eight years of split-type brush consisting of two parts, each half the thickness of the usual solid brush. Both the change in material and this splitting have resulted in the brushes maintaining more intimate contact with the commutators particularly at high speed and have effected a marked improvement in commutation.

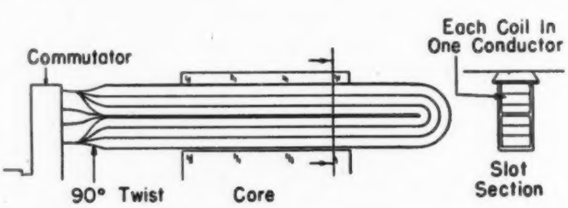


Fig. 8—Twisted-lead armature coil

Binding and Wedging

The windings of most armatures today are held in the core slots by means of wedges where magnetic steel binding wire was used. When non-magnetic steel wire was developed, it was used where needed as a means of reducing cross slot flux, thereby improving commutation; and also, as a means of reducing band losses, thereby improving rating. With further increases in core speed and corresponding increases in the required amount of binding wire, it became necessary, about 1930, to begin to use slot wedges in the core portion. This change eliminated banding loss in this region entirely and increased heat dissipation from the core teeth. Core speeds today are approaching 13,000 ft. per min. at the maximum permissible vehicle speed in service.

To bind the end windings down solidly, "re-roll banding" is used on some of the higher-speed motors. This operation consists of applying a layer of binding wire, anchoring it at both ends but running one strand over a pulley which is arranged to apply tension in this loop and to take up any slack. The wire is reeled over this pulley as the hot armature is rotated, and the high-tension loop travels backward and forward across the winding surface distributing the pressure to all portions of the winding.[1]

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[1] This process was described in the January 1948 issue of *Railway Mechanical Engineer*, page 32.

Ventilation

Ventilation has been increased on most traction motors, particularly the larger sizes which today are blown somewhat harder than was considered economical a few years ago. Early traction motors were made to rely more upon thermal capacity than those designed today. Some 30 years ago, motors were series ventilated, a practice which limited the amount of air to that which could be forced through the armature. Today practically all traction motors are multiple ventilated, the air going through the machine in two parallel paths, one through the armature

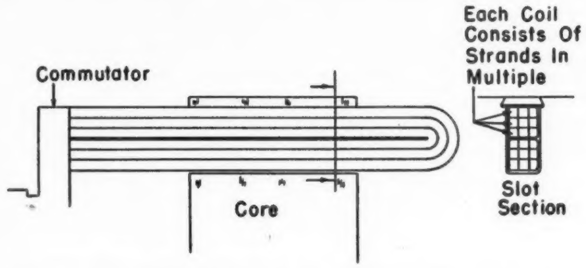


Fig. 9—Conventional stranded conductor armature coil

and the other through the air gap and between the stator coils. In the case of motors insulated for 600 volts or less, the air velocity has been increased in the last 10 years from about 3,000 ft. per min. to its present approximate value of 5,000 ft. per min. On the higher voltage, thicker insulated motors, it has not been found worthwhile to blow very hard due to the thermal resistance of the dielectric.

Insulation

The size of a given motor is affected to a marked degree by the thickness of the insulation. Thick insulation not only reduces the amount of available space for copper or steel but also increases the resistance of the thermal path by which heat must escape from the copper. The problem is to obtain an insulation that is consistently good, that may be applied with normal shop handling without becoming damaged, and one that in service will stand Class B temperatures or higher.

Class A materials are not being used on modern traction motors. Mica has been, and still is, the basic Class B insulating material. Mica insulating tapes and sheets have been improved by the use of thinner retaining paper. This newly-developed material is but one-half mil in thickness —approximately half the former thickness—but has adequate strength. As this paper is permitted only as a means of applying the mica, the less used, the more heat proof and more strictly Class B is the insulation. Increasing use is being made of glass-baked mica tape which completely eliminates Class A material from the insulation.

Glass outer protective insulation has largely supplanted asbestos. The glass has more tensile strength making possible a tighter taping or wrapping of coils and also a saving in insulation space.

A change was introduced about eight years ago in the method of insulating commutating coils where fields may be connected in the circuit at approximately ground potential, and where the motor is for use on locomotives operating on internal power. The so-called "mummified" type of insulation in which the coil is completely taped together, has been abandoned as being unnecessarily large and heavy for this particular kind of service. Instead, the first two or three turns, depending upon creepage needed, are taped separately with ground insulation providing full thickness on the end turns and tapering the insulation to provide fewer tapings on the inner turns. Center turns are left bare. The commutating pole is wrapped with insulation, the coil assembled on the pole, the entire unit impregnated in synthetic varnish, clamped on blocks to simulate assembly in machine and cured in an oven into a practically incompressible, hard unit.

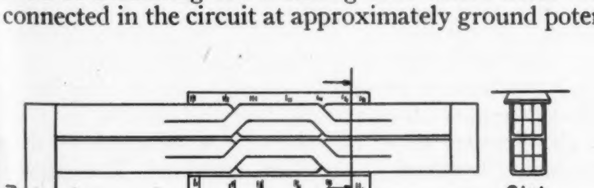


Fig. 10—Double cross-over bar armature winding

Coils of this type are used on small locomotives, where only one connection of motors is required. On larger locomotives motors where two-motor combinations make necessary operation of field coils at more than ground potential, a similar coil is now being used, mounted on a metal spool instead of directly on the pole. Permafil, a new synthetic thermo-setting varnish, is used for mica insulation bonding and final impregnation. Center turns on these coils are individually glass taped. These coils are air-cured, clamped in a mold and heat-treated into an essentially incompressible, hard unit which, however,

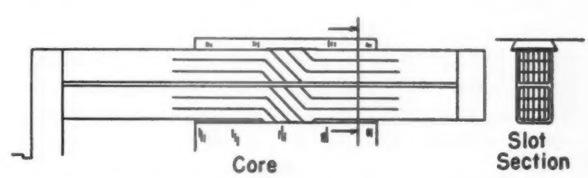


Fig. 11—Folded bar armature winding

differs from the smaller coils in that the commutating pole is removable. The design is indicated in Fig. 7. The coils are held in place on the pole by means of multiple-leaf, non-magnetic spring pole tips.

Reduction in Use of Castings

The past quarter century has seen much of the work that was once done in the foundry transferred to the fabricating and welding shop. Only in the largest size magnet frames are castings used more than fabrication. Wherever possible frames have been changed from octagonal to round and formed by rolling.

Commutator shells and caps are now generally made from forgings instead of castings wherever the quantity involved is great enough that this construction proves most economical. Frameheads are being "hogged" more and more from ordinary heavy welding plate instead of being made from castings.

Electrical Design

Although not so apparent, a number of changes in electrical design have been made during the past few years. Many of the more recent motors have made use of the twisted-lead type of armature winding, Fig. 8, instead of the solid, deep bar; the stranded wire type, Fig. 9; or the transposed bar types, Fig. 10 and 11. The twist-lead type of armature coil offers high slot-space efficiency combined with low eddy-current loss, both effecting increases in armature capacity. The cost of the twist-lead type is also lower than that of the transposed-bar types. It is on the motors with three or more coils per slot that the twist-lead type of coil offers a gain in combined space efficiency and low loss as compared to coils of the other types. The more coils per slot, the more the gain on both counts, making this type of coil most useful in higher

voltage motors—particularly those for 3,000-volt trolley operation.

While resulting in a reduction in heating and increase in rating, the use of a shallow conductor increases the problem of obtaining a suitable adjustment of compensation to meet the requirements of all coils in a given slot. The eddy currents of the deep conductor tend to equalize

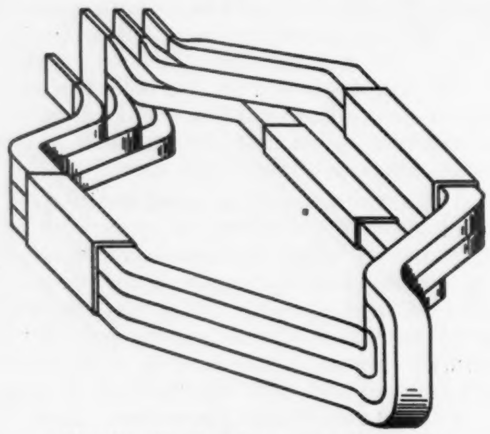


Fig. 12—Orphan-type armature coil

the rate of change of current in the several coils during commutation, and also tend to cause some of the energy of commutation to appear in heat rather than sparking. The proper balancing of commutation difficulties against heat reduction is always a problem for any shallow conductor winding when it is used where commutation is inherently difficult.

Windings of the bar type have been used for many years in coils in which the back pitch is not a multiple of the coils per slot. Coils of this type are usually brazed at the end opposite the commutator, necessitating a removable flange and special molded flange insulation; all tending to make this type of coil expensive. There is, however, a definite gain in reduced commutator maintenance when this type of back pitching is used as compared to similar motors where the coil back pitch is a multiple of the coils per slot. In order to take advantage of the twist-lead coil and still use the special back pitching of the bar-type coil, many motors now use a modified form of this twist-lead type of coil which is ordinarily known as the "orphan coil." The design of this type of coil is indicated in Fig. 12. Such windings have slot space efficiency comparable to the bar types and are somewhat less expensive in overall armature cost.

About 1930, it was found advantageous to increase the amount of iron and decrease the amount of copper compared to the ratios previously used. The optimum proportion insofar as the armature is concerned has been found to be about two parts of iron to one part of copper in the effective circumference of the armature. This proportion works out well on motors having more than four poles. On four-pole motors, it has generally been found advantageous to use a little higher percentage of copper to avoid excessive flux density in the armature core beneath the teeth.

In order to reduce peak voltage between adjacent commutator bars caused by flux distortion, it has been found desirable to increase the air gap from a minimum value at the main pole center to a maximum at the tips. Gaps flared in this way, in addition to reducing flux distortion, also tend to limit losses in the tips due to pulsation in flux caused by the passing of the armature teeth.

Standardization

In the last 20 years, much progress has been made in all lines of traction motors toward the adoption of standard machines.

The internal-power locomotive offers the best possible opportunity for standardization on a widely applicable motor for several different weights of locomotive. The motor shown at the right in Fig. 5 is used on 25, 45, 50, 65, and 80-ton locomotives. Different numbers of motors per locomotive and different gear reductions are used depending on the maximum speed desired, which ranges from 25 to 50 m.p.h. This motor is made to be applicable on any track gauge down to 36 in.

For road locomotives of 50,000 lb. per axle or over, each manufacturer appears to have adopted a standard motor. Generators are designed to fit the motor since there is less than half the cost in the generator that there is in the motors of a four-motor locomotive. Not only is there a greater percentage of the equipment cost in motors than in generators, but there is also a larger number of maller units. Both of these considerations favor motor rather than generator standardization.

It is of interest to note that the motor for internally-powered locomotive is being reduced in size to a point where wheel diameter, instead of being determined by motor size, is now in some cases on the heavier road locomotives being determined by the weight on the driver,—i.e., by the pressure on the rail. This situation is new and is welcomed as a possible aid to motor standardization. If the wheel rather the motor does become limiting, a greater freedom is allowed in the choice of gearing for a small motor or, conversely, the way is opened for a more universal motor not requiring specialized gearing.

Maintenance—Unit Exchange

The railway motor of today, like the automobile of today is more complex, much more of a precision tool, and inherently more difficult to maintain than was the slower speed motor of 20 or 30 years ago. As in the automobile service shop, the problem of keeping the traction motor service shop fully informed regarding improved factory methods is one that is being solved by specialized training of service personnel supplemented by factory instruction sheets. The improved processes for binding, balancing and spinning armatures and improved equipment for handling and testing is being used in the service shop as well as the factory in order to insure uniformly good operation from new and from rebuilt equipment.

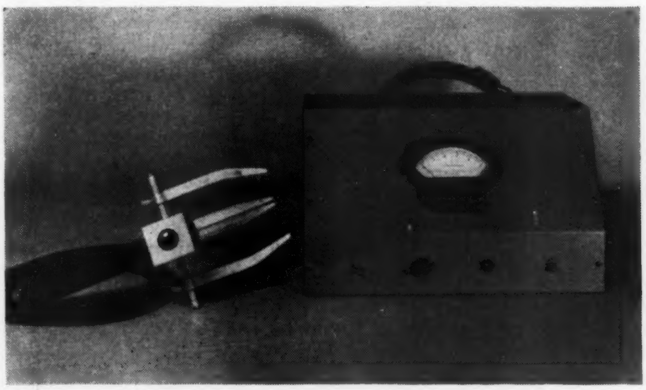
Little of the increased maintenance problem is apparent to the operating railroad which uses standardized motors where unit exchange is available. Under the unit-exchange system, the operator turns in a motor needing service and receives, with essentially no delay, a rebuilt motor in exchange. This method of handling service is one of the most important results of standardization which is not possible with custom-built apparatus. The system of unit exchange spreads the cost of specialized servicing equipment over many users of a given motor.

Conclusion

The principal way in which power per pound has been increased during the past 25 years has been by means of increases in speed. Considering the limitations imposed by available known materials—fundamentally copper, steel and mica—this increasing of speed has proved to be the only way to accomplish progress in traction-motor design. Much work is currently being done developing new synthetic insulating materials which may one day clear the way to increased specific output. Higher than Class B temperatures are also being advocated for railway work. Further speed increases are to be expected despite increasing mechanical problems involved. The curves of output per pound are continually increasing. The interesting problem presented to the engineer is to see that they continue to do so in the future.

High-Frequency

Bar-to-Bar Armature Testing



Portable electronic bar-to-bar tester with lightweight test prod unit, adjustable for various commutator diameters and bar spacings—The cathode ray indicator is mounted on the test prod to facilitate rapid testing—The tuning control, on-off switch, meter and its control switch, are mounted on the instrument case panel—The tuning control is adjusted only at the start of the test on an armature

Two methods of bar-to-bar armature testing have long been in use. One is to circulate a heavy direct current through a portion of the winding and then to measure, with a millivoltmeter, the drop across two adjacent bars. This method, and its adaptations, is essentially a resistance test.

The other general method is to apply 60 cycles or other low frequency, low voltage, alternating current to several commutator bars and then to listen with a headphone to the signal picked up from two adjacent bars.

Both of these methods are limited to the application of a small fraction of a volt between bars on the average armature, whereas in operation the armature will be subjected to several volts between adjacent bars.

During the war period, when many scarcities existed, The National Electric Coil Company, Columbus, Ohio, found itself without an immediate source of supply for repair parts or new equipment of the type of bar-to-bar testers then in use in its service shops. This need led to the development of the electronic bar-to-bar tester here described.

Electronic Tester

The electronic high-frequency bar-to-bar tester is composed of two essential sections mounted in a portable metal case. One section, requiring three tubes, is a vacuum tube oscillator. This oscillator generates an approximate 3,000-cycle alternating current voltage of about 15 volts on load. This voltage is applied to the armature winding through the two outer adjustable prods on the indicator prod unit. The other section of the test unit is an electronic voltmeter. It has an input impedence of 500,000 ohms to the vacuum tube amplifier. The three-tube voltmeter section feeds the cathode ray, or magic eye, indicator tube mounted on the test prod. In addition, the tester has an indicating meter which may be switched in or out of the circuit as desired.

The sensitivity of the indicating unit is very high, be-

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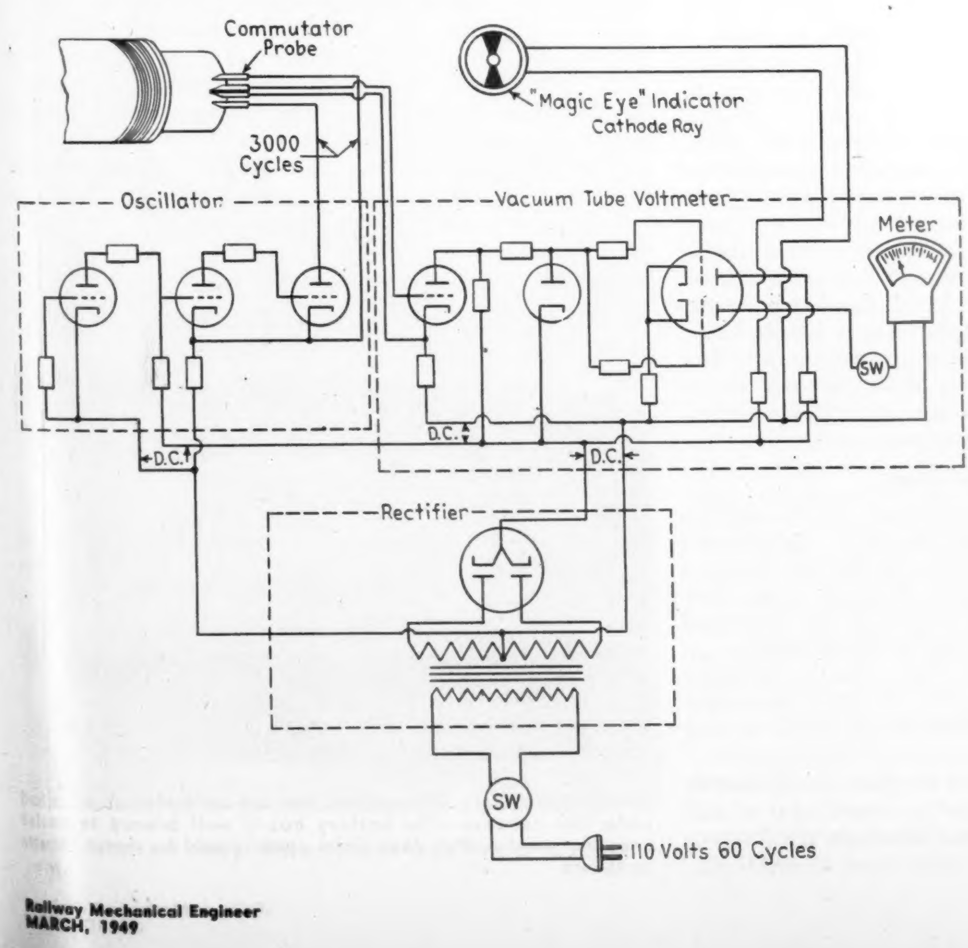
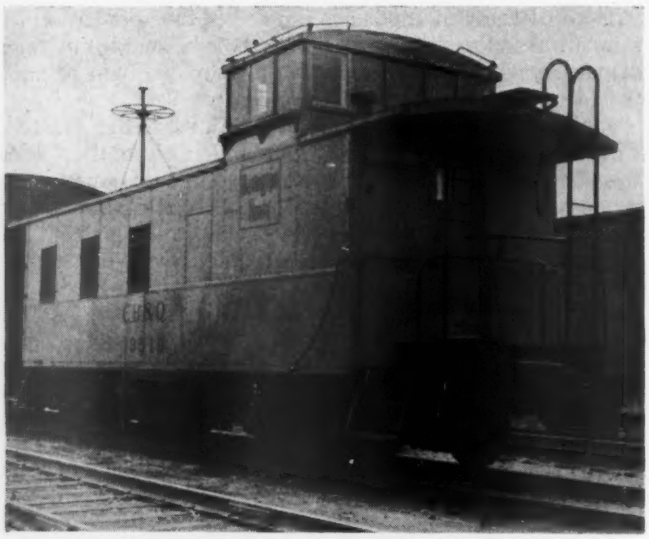


Block diagram of electronic bar-to-bar tester, showing the function of various tubes—The rectifier furnishes plate current to the master oscillator tube, the buffer tube and the oscillator power output tube—The low-current, high-voltage-oscillator, power output is transformed to a lower-voltage, higher-current for connection to the two outer adjustable prods—The input from the two fixed center prods is fed to the sensitive vacuum tube voltmeter, which includes an a.c. amplifier, a d.c. rectifier and a single stage dual d.c. amplifier for feeding the magic eye indicator and the meter

Burlington Using

Space Radio on Freight Trains



One of the lighted and radio-equipped cabooses

Axle generators and batteries supply caboose power for radio and inside lights and markers

ON two adjacent sub-divisions totaling 255 miles between McCook, Neb. and Denver, Colo., the Burlington has installed two-way space radio for communication between the locomotives and cabooses of through freight trains, 31 Diesel-electric locomotives and 8 cabooses being equipped. Portable walkie-talkie radio units, provided in the cabooses, are used by trainmen to communicate with the men in the locomotive or caboose while inspecting the train or when flagging. Each caboose is also equipped with special radio apparatus known as "Slow-tone" which, when turned on by a trainman, sends out a distinctive intermittent tone indicating the presence of that train to other radio-equipped trains in the vicinity.

The project has been in service for some time, during which many benefits to train operation have been revealed, and plans are now under way to install fixed radio transmitting and receiving stations at Akron and Brush, Colo., in the middle of the territory. These transmitters will be controlled remotely from McCook by the dispatcher, and enable him to converse with trains within 20 miles of either side of the remote radio transmitters.

Two Sub-Divisions

The 31 radio-equipped locomotives are pooled in operations on through freight trains between Chicago and Denver, and between Kansas City and Denver, the two sub-divisions between Denver and McCook being common to these two routes. The use of the 8 radio-equipped cabooses is confined to the Denver-McCook territory.

About 20 trains are operated daily on the territory between McCook and Denver. These include 8 passenger and 6 regular freights and as many extra trains as may be needed to handle the traffic.

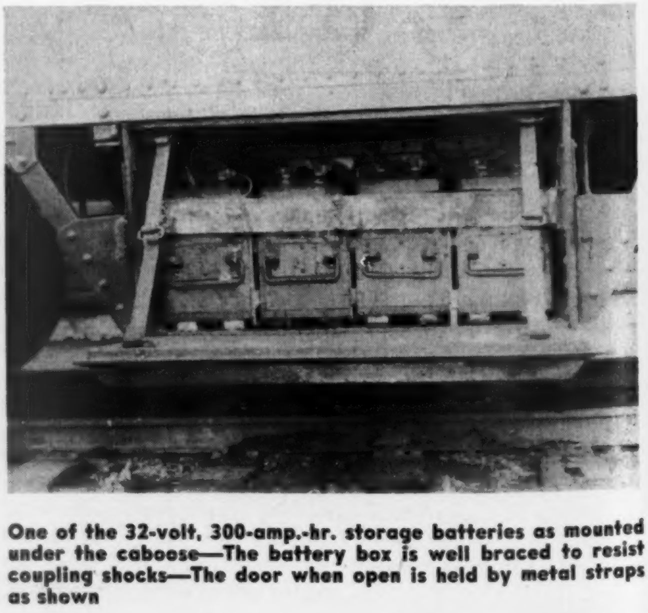
The maximum tonnage handled in either direction runs between 5,500 and 6,000 tons, with a maximum of 125 cars. Twenty of the radio-equipped Diesel-electric locomotives which handle this tonnage are rated at 6,000 hp., and 11 are rated at 5,400 hp. The area through which the railroad runs is subject to some severe rain, snow and sleet storms, all of which contribute to the operating problems.

Day-to-day analysis by Burlington operating officers indicates that on the average the use of the radio avoids an average of 30 min. delay for each through freight train on the 255-mile run under normal operating conditions —no trouble or set outs.

One Transmitter-Receiver on Locomotives

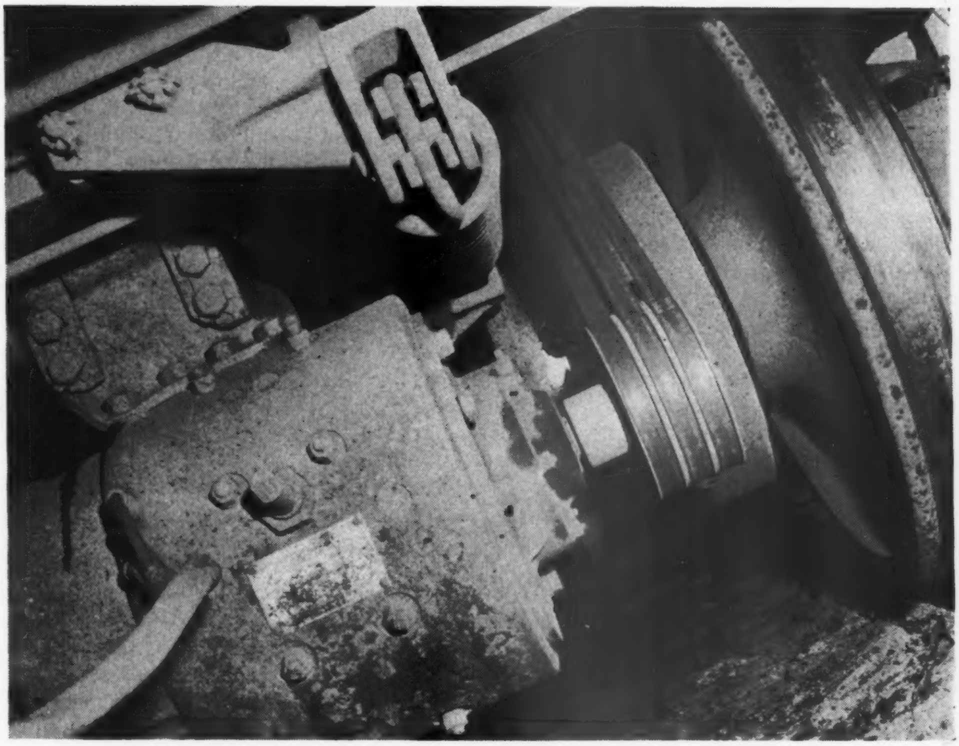
Each double-end Diesel-electric locomotive is equipped with one Bendix Type MRT-1B radio transmitter-receiver, which is placed in the leading nose of the locomotive before leaving the terminal. Both cabs, however, are equipped with a loudspeaker, microphone, control unit and antenna. Each caboose is equipped with an MRT-1B radio transmitter-receiver, a loudspeaker, a microphone at the conductor's desk, a telephone-type handset with push-to-talk switch in the cupola, control unit, MS-112-A slow-tone unit, antenna and power supply. In that these are new cars, careful consideration was given to space for sheltering the radio and power equipment, and special compartments were, therefore, provided on the inside center of the cars. To equip each locomotive with radio and power supply, the equipment cost \$1,000, and each caboose with radio, power and lighting equipment, \$2,500. With present-day costs, however, these figures would probably be about 25 per cent higher.

The radio equipment in each locomotive cab and caboose is designed for two-channel operation, although only one

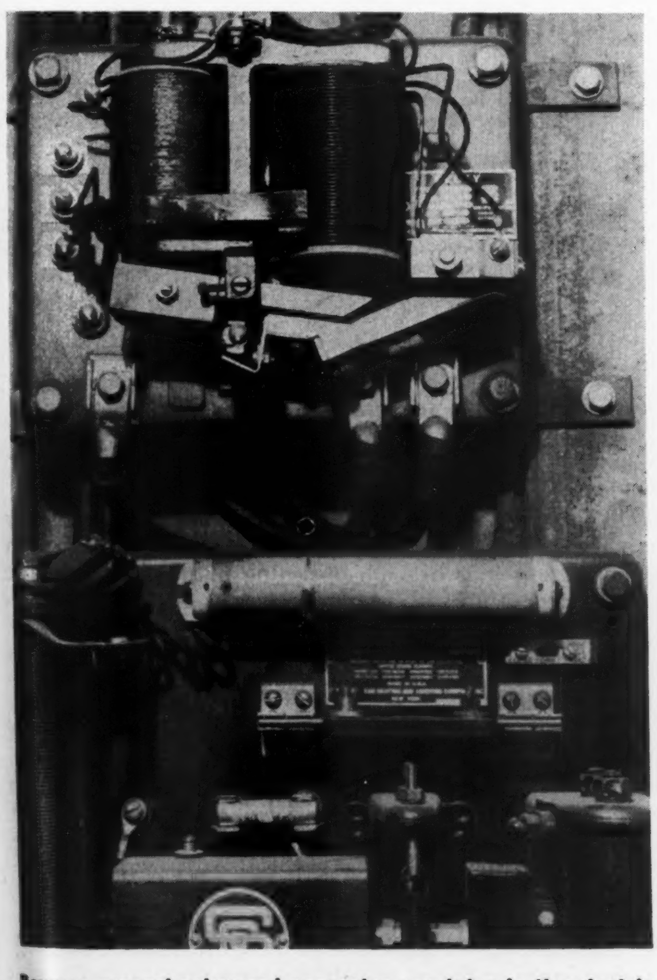


One of the 32-volt, 300-amp.-hr. storage batteries as mounted under the caboose—The battery box is well braced to resist coupling shocks—The door when open is held by metal straps as shown

The 3-kw. Safety generator is driven by three endless Vee belts, the backs of which bear against the flangeless axle pulley—The belts run over an idler pulley back of the axle pulley



channel—159.690 mc.—is used on this project. It has an on-and-off switch and pilot lamp which is lighted when the radio is turned on. A knob is also provided on the control unit to control the volume of the loudspeaker. The slow-tone control unit in the cabooses is similar in size and appearance to the radio control unit, to which it is adjacent. It consists of a red on-and-off switch and a red pilot lamp which is lighted when the unit is turned on. This unit imposes a 750-cycle audio tone on the transmitter carrier, and is started by the flagman whenever he leaves the caboose to protect the train. The walkie-talkie radio units assigned to the territory are the Bendix Type MRT-2B. They weigh 15 lb. and have a maximum transmitter output of 1 watt.



Reverse-current relay and generator regulator in the electric locker

Different Types of Antennas

The locomotives and cabooses are equipped with a Bendix MS-144A top-loaded ¼-wave vertical antenna. The base of the antenna on the locomotives is 14 ft. 6 in. above the top of the rails and mounted behind the horns, while on the cabooses, the antenna is mounted on the car roof with the top of the antenna 10 in. above the cupola roof.

These antennas are constructed to support a 200-lb. man. They are at ground potential and a man will be unharmed if the antenna is touched while the transmitter is in operation. The antenna is fed power by a co-axial cable transmission line to the transmitter.

The microphone in the locomotive cabs and at the conductors desk in the cabooses are the Electro-Voice Type 600-D. This is a dynamic-type hand-held microphone. The handset in the cupola is the dynamic telephone type with the push-to-talk switch in a handy position for the operator's finger control. The loudspeakers on the locomotives and cabooses are the 6-ohm permanent-magnet type and deliver 10 watts of audio. The radio equipment is wired in a conventional manner, using electrical conduit and appropriate fittings, flexible cables being used for attaching the dynamotors, transmitter and receiver units.

Power Equipment

Voltages for operation of the radio equipment on the locomotives is derived from a carbon-pile regulated dynamotor, which operates off the 64-volt engine storage battery. The dynamotor has an output of 325 volts for the plate circuits and a 13-volt output for the filament circuits.

It is a 4,000-r.p.m. ball-bearing unit which is dust and water tight.

For radio and lighting power on the cabooses, each car is equipped with a 32-volt, 300-amp.-hr., lead-acid storage battery. The radio current drain is 9 amp. on standby and 12 amp. when transmitting. The battery is housed in two battery boxes under the car—8 cells on each side—and charged by a Safety Car Heating & Lighting Company 3-kw. axle generator, provided with conventional generator and lamp regulators. The dynamotor for the radio equipment, and the caboose lights are supplied from the 32-volt power supply. The lights include two ceiling lights, a cupola light, a desk light, two lights in a power cabinet in the center of the car which are controlled by door switches, as well as electric markers when used.

The voltage regulator and reverse-current relay associated with the axle generator equipment are mounted on a rack in the power cabinet. This includes, from top to bottom, a Type-04 switchboard, Type-S 700E carbon-pile regulator for the caboose lights, Type-S 10EA relay and a Type-S 75EA carbon-pile regulator for the axle generator.

As a means for giving the caboose batteries additional charge, if necessary, two portable gasoline-engine-driven generators, mounted on wheels, were provided—one at McCook, and the other at Denver. These units, furnished by Fairbanks-Morse, were made by D. W. Onan & Sons. The output at 2,000 r.p.m. is 50 volts, 70 amp.—3,500 watts. Each unit is equipped with an extension cable and plug to fit standard battery-charging receptacles mounted on both sides of the cabooses.

Power for operation of each walkie-talkie is derived from a small 6-volt dynamotor in the radio pack, which operates from an 8-volt Willard lead-acid storage battery which weighs 3 lb. The filament circuits are fed directly by a 2-volt tap on the battery, while the plate circuits are fed from the 135-volt output of the dynamotor. The battery in each walkie-talkie is good for one 6 to 8-hr. return trip between McCook and Denver. An automobile disc-type battery charger is in service in the wire chief's office at McCook for charging the batteries, the charger as well as the walkie-talkies being equipped with plug connections for quick removal of the batteries.

Radio Maintenance

Major repairs and maintenance of all the radio equipment is done at the Burlington's telegraph repair shop at Aurora, Ill. Special shipping boxes, lined with rubber, are used to ship the units from outlying points. Spare radio units and road maintenance men are available at two points—Chicago and McCook.

This installation was placed in service under the direction of H. C. Murphy, vice president operation, and H. H. Hasselbacher, superintendent telegraph, and under the immediate supervision of T. W. Wigton, supervisor of electronics. The major items of radio equipment were furnished by the Bendix Radio Division of the Bendix Aviation Corporation.

CONSULTING DEPARTMENT

Can you answer the following questions? Answers should be addressed: Electrical Editor, Railway Mechanical Engineer, 30 Church Street, New York 7.

Good lighting depends upon a good installation that is adequately maintained. Can you suggest some way of encouraging railroad users to keep their lighting systems in good condition?

To what extent are solderless terminals and connectors suitable for railroad application?

Effect of Commutator Condition on Brushes

What effect does commutator condition have on brush performance?

There Are Two Kinds of Commutator Irregularities

Commutator condition directly affects the efficiency of commutation and brush life. The perfect commutator is absolutely concentric, free from surface irregularities circumferentially and axially. Its design and manufacture assures maintenance of these qualities under normal operation conditions.

Departures from these ideal conditions are due usually to the lack of uniformity of expansion and contraction under conditions of high operating temperatures. These temperatures are produced by current flow, brush friction at high peripheral speeds, or both.

Railroad tests have proven that high peripheral speeds account for high commutator temperatures with or without current flow.

Eccentric commutators, usually considered as such when eccentricity exceeds .0015 in., can be placed in two classes—those with sudden irregularities and those with gradual irregularities. The sudden irregularities consist of individual bars which are high or low. Gradual irregularities are the result of the periphery becoming "egg-shaped".

Both of these conditions are due to lack of uniformity of expansion and contraction of the individual bars during temperature variation which, on some high speed applications, have exceeded 140 deg. C.

The effect of this condition on brush performance is that the brush cannot maintain consistent contact with the commutator resulting in poor commutation, deterioration of the commutator surface and burning of the bars through arcing between brush and commutator, chipping or breaking of the brush at the contact surface—all of which developments lead to flashovers and heavy repairs.

Tightening and seasoning of the commutators have alleviated this condition on railroads operating commutators at peripheral speeds of 8,000 ft. per min. and up.

The actual effect of such commutators on brush performance, electrically, was shown in oscillograms published in the December issue of *Railway Mechanical Engineer*.

WALTER F. FAUERBACH
Morganite, Inc.
Long Island City, N. Y.

Commutator Condition Must Not Be Allowed to Become Bad

Symtoms that one may expect to find if the condition of a commutator is permitted to progressively change from bad to worse include rapid brush wear, chipping at the brush face, and finally even complete shattering of the carbon brushes. In their later stages, such conditions will result in motor flashovers. A motor flashover will in turn probably cause the generator which drives the motor to also flashover. It is therefore of decided advantage to never allow the condition of a commutator to deteriorate to such a point.

If any of the above symptoms are present, a check of the profile of the commutator brush surface with a dial type indicator will often locate the trouble. When making this check, it must be born in mind that it is usually not the maximum-to-minimum, or total "run out" reading, that shows the greatest significance. Pressure applied on the top of the brush enables it to follow gradual rises and falls corresponding to any reasonable amount of eccentricity of the commutator surface. However, a brush cannot, because of its inertia, follow abrupt dips in the surface of a commutator rotating at high speed, but will tend to ski-jump over them. If a high bar is present, it will kick the brush causing it to bounce away from the commutator. In either case the brush will have lost contact with the commutator and severe sparking or arcing will result. This arcing not only burns the brushes, but also tends to further roughen the commutator.

The main purpose in using the dial indicator is, therefore, to determine whether the profile of the commutator surface is sufficiently uneven to be the probable cause of poor brush performance. The important thing to look for is any sudden dip or swing of the dial indicator needle as the armature is revolved slowly. Changes in the reading as small as 0.001 in. are significant if they occur in the space of two or three segments. If the commutator is one that operates at high speed, any spots that are low by as much as 0.003 in. should certainly be corrected at the earliest opportunity.

Whenever the amount of commutator copper to be removed is not too great, grinding with a commutator dressing stone is usually the preferred method. For satisfactory results the grinding stone should be rigidly clamped in a fixture rather than held in the hand. The fixture should provide both a traverse motion and a sensitive feed motion similar to that of a tool post on a lathe. The grinding process may be performed with the machine in place in the locomotive if desired. At least one brush holder is removed to provide sufficient room for, and a convenient surface on which to mount, an adapter to which the grinding fixture itself can be attached.

In the case of a generator, the hard-to-reach brushes are first removed, and the field excitation contactors blocked open as a safety precaution. After cranking the Diesel engine, the remaining brushes are also removed. The engine should be operated at or near its idling speed during the commutator grinding process.

In the case of a traction motor, the axle journal boxes and the motor magnet frame may be jacked up and blocked so that the wheels are held clear of the rail. A welding set connected to the motor terminals provides a convenient and, in most cases readily available, source of driving power. About half the normal number of brushes should be left in place to carry the current which will be required to turn the motor, gearing, axle, and wheels at about one-fourth their normal maximum speed. It is essential that the motor or generator have all its commutator mica grooves thoroughly brushed or raked free of any adhering copper slivers or fins and that the machine be very thoroughly blown out with a compressed air hose to remove all loose copper particles before it is put back into service.

If a commutator has low bars and is in need of truing-up, it is advisable to check two things before proceeding further. First; is the burning the result of loose segments? Tapping each segment with a very light hammer and feeling for any signs of vibration with the finger tips should settle this point. Second; have the segments been annealed by the motor having stood still too long with power on? The relative hardness of the burned segments as compared to the adjacent unburned segments can best be checked by means of a scleroscope. Unfortunately, the motor must be removed from the locomotive in order to use this device. As an alternative it is possible to make a modified Brinell hardness test with the motor still in place. Any commutator having either loose or annealed segments should be suitably repaired before attempting to restore its surface to a true cylindrical form. Otherwise it will be found necessary to repeat the operation after only a brief period of service.

R. LAMBORN
Motor Engineering Division,
General Electric Company,
Erie, Pa.

Nature of Surface Film Is As Important as Regularity of Contour

The question which provides the topic for this discussion might be answered in one sentence: "Any imperfection in the commutator surface unfavorably affects brush performance." On the other hand, a volume might be written in discussion of the great variety of commutator surface conditions encountered in service, and the effects each one has on brush performance. *In order to simplify the reply to the stated question, consideration will be given to only a few of the more commonly occurring types of surface imperfections. These include eccentricity, minor surface inequalities, burning on commutator surface, surface film failure, high friction glaze and effects of contaminated atmosphere.

The term eccentricity is used in respect to commutator contours to define departures of considerable circumferential span from true cylindrical contour, as well as to define cylindrical surfaces which are not concentric with the axis of rotation. On commutators of low angular velocity (low r.p.m.) eccentricity of considerable magnitude can be tolerated without unfavorable effect on brush performance. On the other hand, at high angular velocity, brush performance may be disturbed by eccentricities as small as 0.001 to 0.002 in. Disturbance of brush performance occurs whenever the revolving surface deviates

*See—"Modern Pyramids" Bulletin No. 6, published by National Carbon Co., Inc.

from that of a true concentric cylinder at a more rapid rate that the inertia of the brush and pressure finger permits the brush to follow.

Minor surface inequalities are a frequent source of imperfect contact between brushes and commutator with resultant sparking. High or low commutator bars, bars which are higher on one edge than on the other and protruding fins of mica are among the more common types of disturbing surface inequalities. The permissible magnitude of such defects is less than that of the broader surface defects defined as eccentricity because their rate of deviation from a true cylinder is very high. On high speed commutators surface irregularities of a few ten thousanths of an inch may produce very high impact at the brush face. For this reason, it is desirable that bar-to-bar deviation should not exceed 0.0005 in. on commutators with high surface or rotative speed.

Burning of the commutator surface may range in severity from a thin line of the bar edge burning to flat or burned spots covering a span of several bars. The disturbance to brush performance is somewhat in proportion to the area of the burned surface. Sparking is usually the immediate cause of such burning but, since the burned surface provides imperfect contact with the brush face, sparking is intensified once burning has begun and the fault tends to magnify itself. Cleaning up of the commutator surface will seldom effect a permanent cure unless the primary cause of sparking is determined and corrected.

Failure of the commutator surface film not only creates an unsightly, streaked appearance on the commutator but may lead to more serious operating faults. Noisy brush operation and sparking usually accompany film failure and accumulation of copper in the brush faces is also frequently experienced. The latter condition may lead to threading or serious grooving of the commutator surface. It also tends to disturb the even distribution of current among the several brushes on the commutator and, extreme cases, results in such faults as glowing of the brush face, overheating of individual brushes and even burning off of some of the shunt cables.

Commutators sometimes acquire a highly polished surface, fairly light in color and free from any type of marking, yet accompanied by noisy brush operation and indications of high friction between the brushes and the commutator surface. The appearance of such a commutator surface can well be described as that produced by burnishing. Because of the indications of high friction, such a surface condition is sometimes defined as a "high friction glaze". The circumstances which result in the development of such a surface condition are somewhat obscure, however, its favorable effect on brush operation can usually be corrected by the use of a mild abrasive such as a brush seating stone. This breaks down the glaze without seriously disturbing the desirable surface film or removing any appreciable amount of copper from the commutator.

Numerous imperfections of commutator surface result from atmospheric contamination of various types. Abrasive dust in the air is sometimes the cause of rapid brush and commutator wear or may prevent the development of a good commutator surface film. Oil vapor tends to build up a high resistance film on the commutator which ultimately breaks down the results similar to those which follow failure of the desirable type of commutator surface film. Such faults as glowing and accumulation of copper in the brush faces are more pronounced in the presence of oil vapor than when the machine is operated in an uncontaminated atmosphere. Atmospheric contaminants, such as vapors from alcohol or carbon tetrachloride, are especially bad in their effects on brush performance. They destroy the normal film on the commutator leaving a raw surface, producing very high friction and lowering the contact drop. Sparking, chattering of the brushes, threading of the commutator surface and even severe commutator wear are some of the effects which follow disturbance of the normal commutator surface film by atmospheric contamination.

It is apparent from the foregoing paragraphs that good brush performance is dependent to a very large degree on the condition of the commutator surface. It should also be apparent that the nature of the surface film is as important as regularity of contour. Space permits mention of only a few of the commutator surface conditions affecting performance but the points which have been discussed indicate the need for close attention to commutator surface conditions as a part of the overall maintenance program.

C. G. OLLINGER
National Carbon Company, Inc.
New York, N. Y.

High-Frequency Bar-to-Bar Armature Testing

(*Continued from page* 151)

cause of the input impedence of 500,000 ohms. This means that high resistance shorts can be detected. Since alternating current is circulated in the d.c. armature during operation, this high frequency a.c. bar-to-bar test is in line with normal operating conditions as referred to voltage. However, the current circulated in the winding is very small, and the ability to pick up poor soldered or brazed connections is limited.

This means that if we have one bar with a resistance of .001 ohms and in the adjacent bar a resistance of .0097 ohms, no difference in reading will be indicated on the electronic cathode ray tube. High resistance joints cause relatively few failures, since the length of the high resistance part of the circuit is short, resulting in a very small increase in the total I^2R losses. On the other hand, the majority of armature failures occur either by breaking down of the ground insulation and/or the turn-to-turn or bar-to-bar insulation. Therefore, the bar-to-bar tester is superior (from the standpoint of insulation testing) to high-current, millivoltmeter type testers.

In the course of its use in the shop, the instrument has been made rugged. This shop usage has eliminated the "bugs" which may be expected in a laboratory-type development. The vacuum tubes are all popular types which are in current production. The instrument does not have to be recalibrated when a tube is replaced, nor does it require specially selected tubes for the oscillator section. The tubes give good service in hard production-shop usage. The indicating "magic eye" tube has no moving parts and, therefore, has no inertia. This means that testing an armature is a fast operation.

The meter is used to locate a short or partial short indicated by the eye tube. It can be read in actual units and, therefore, permits calibration of the indication.

In operation the tester is connected to a 110-volt, 60-cycle source of power and the test prod is applied to the commutator, so as to span as many bars as possible, with the same number of bars on each side of center. The dial knob is then turned and the circuit thus tuned so as to just close the eye.

The first bar is then chalked and the operator proceeds around the commutator. A shorted bar is indicated by the complete opening of the eye. The eye will open partially on bars spaced one pole pitch apart away from the short. On an open circuit or a crossed coil, the eye overlaps.

NEW DEVICES

Welding Electrode

For welding of high-sulphur, high-carbon, low-alloy high-strength and hardenable steels, the Champion Rivet Company, Welding Division, Cleveland, Ohio, has developed the Hy-Lo Electrode, A.W.S. E7015.

Hy-Lo can also be used to weld parts that are to be galvanized or porcelain enameled, steel of doubtful analysis, manganese or spring steel to mild steel, locomotive frames and flexible staybolt sleeves, etc. In addition to this Hy-Lo, Champion also supplies this Electrode in the higher tensile ranges of A.W.S. E8015, E9015 and E10015.

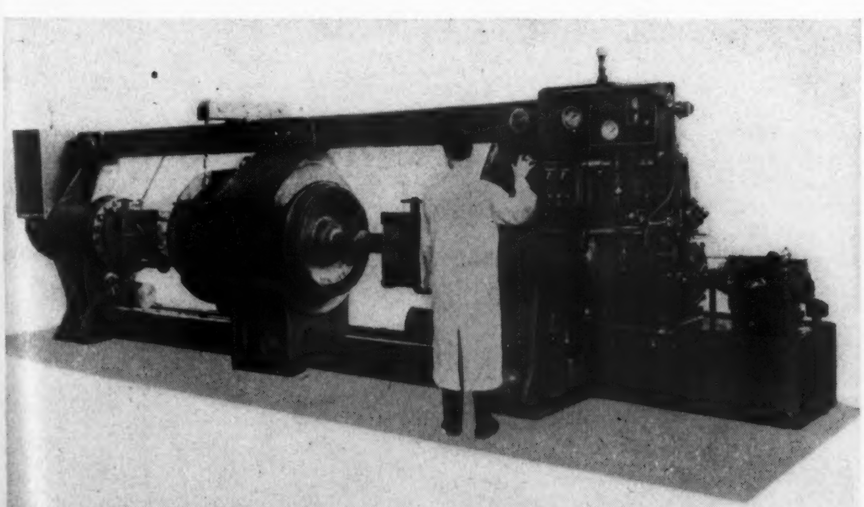
Double-End Wheel-Mounting Press

A production de-mounting press, capable of handling all types of railroad wheel sets without the use of spacers has been developed by the Watson-Stillman Company, Roselle, N.J. The double-end machines, with 54-in. clearance between bars and a stroke at each end of 26 in., are available in 400- and 600-ton sizes.

This machine has the ability to de-mount Diesel locomotive wheels on a production basis without disturbing the drive gear. A special beam can also be furnished as an extra to remove passenger car wheels without pressure being brought to bear on the Spicer drive.

Single-station push-button controls initiate all movements of the press. Rapid traverse is provided for all idle portions of stroke. Positive overstroke protection is designed to prevent cocking of rams in service.

The press can also be used for mounting car wheels and axle assemblies, and all the gauges and recording instruments necessary for this purpose are included as part of the standard equipment.



The Watson-Stillman double-end production mounting and de-mounting press for locomotive and car wheel-sets can de-mount Diesel locomotive wheels without disturbing the drive gear

Rear View Mirror

A combination rear view mirror and windshield wing through which the engine crew can look back along the entire length of the train from a normal operating position without distraction from the job of operating the train has been introduced by The Prime Manufacturing Company, 1669 South First Street, Milwaukee 4, Wisconsin.

The Prime rear view mirror applied to a Diesel locomotive

The rear view mirror is built into the lower portion of the windshield wing and utilizes that area of the wing which is below eye level and therefore has no value for forward vision. The wing as well as the mirror can be finely adjusted, resulting in protected vision forward and clear vision backward, regardless of the sitting position of the engineer or fireman.

The wing is supplied mounted on a wood filler block for installation to any window. The mirror and wing can be furnished for the right or left side of the locomotive. It is applicable to road engines, transfer and switching locomotives, either steam or Diesel, and to cars and cabooses.

Portable Shear

An addition has been announced to the line of Porto-Shears made by the Black & Decker Manufacturing Company, Towson 4, Md. The 12-gauge Porto-Shear, as the tool is known, will cut 12-gauge standard sheet steel, approximately two gauges thinner in Monel metal and stainless steel, and approximately 50 per cent above this rating in sheet copper, aluminum, lead and other non-ferrous metals.

This portable shear will follow an irregular pattern because the cutting blade is always visible, and it will cut on a radius as small as 1½ in. A rapid reciprocating action of the vertical blade against the stationary horizontal blade makes the cut. A universal motor delivers 1,100 strokes per minute at full load.

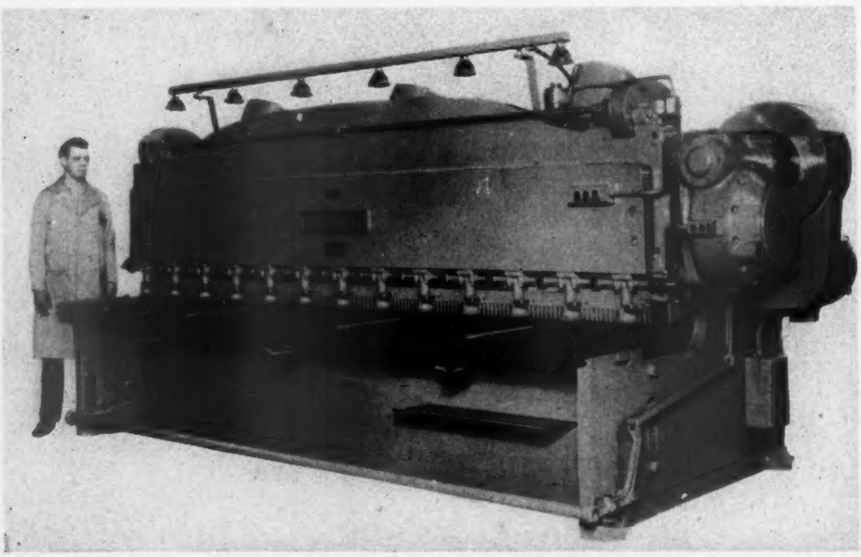
The Black & Decker 12-gauge portable shears

The 12-gauge Porto-Shear may be held in any position, over-top to rear-end. The handle contains an instant-release trigger switch with a locking pin for continuous use. The shear is full ball-bearing equipped except the eccentric which operates in a phosphor bronze block.

Standard equipment includes one set of Porto-Shear blades; a set-screw wrench; 3-wire cable and plug; trigger switch with locking pin; and a universal motor which operates on either alternating or direct current.

Low-Rake Shear

The latest model Cincinnati all-steel shear has a capacity of 1/4 in. of mild steel 12 ft. long and features a very low rake or shear angle to the upper knife to insure sheared strip with a minimum of twist, bow, or camber.



The Cincinnati shear which features a low rake angle to the upper knife to minimize twist, bow and camber

The rake is designed to give a minimum of twist on very narrow sheared strips. The model illustrated is capable of shearing 10-gauge strips, 1/4 in. wide and 10 ft. long, without twist.

Another feature is the Cincinnati light beam shearing gauge. Light intensity has been increased by ten times through the use of General Electric projector floor lamps. Table lighting has also been increased. The light beam shearing gauge is useful when shearing to a scribed line in the production of gussets and other irregular shapes.

This low-rake all-steel shear is made by the Cincinnati Shaper Company, Cincinnati, Ohio.

Arc-Welding Electrodes

Four electrodes, designated as types W-60, W-61, W-62, and W-95, have been developed for use in a wide range of arc-welding operations by General Electric's Welding Equipment Divisions, Schenectady 5, N.Y. The W-95 was developed to deposit hard wear-resisting weld metal in all positions, using a.c. or d.c.

Type W-60, designed to meet the need for an electrode with a low-hydrogen coating, manganese-molybdenum analysis, and good usability characteristics, is suitable for welding most hardenable steels where the hazards of under-bead cracking are to be eliminated. The range of weldable materials includes low-alloy, high-sulphur, high-carbon, high-manganese, and similar high-hardenable and high-tensile steels.

The Type W-61, a low-hydrogen electrode of a molybdenum-vanadium composition, can be used with either a.c. or reverse-polarity, d.c., to weld a wide variety of low-alloy steels. It is especially suited for welding low-alloy pipe, including carbon-molybdenum and chrome-stabilized carbon-molybdenum and new varieties of pipe considered as high-tensile.

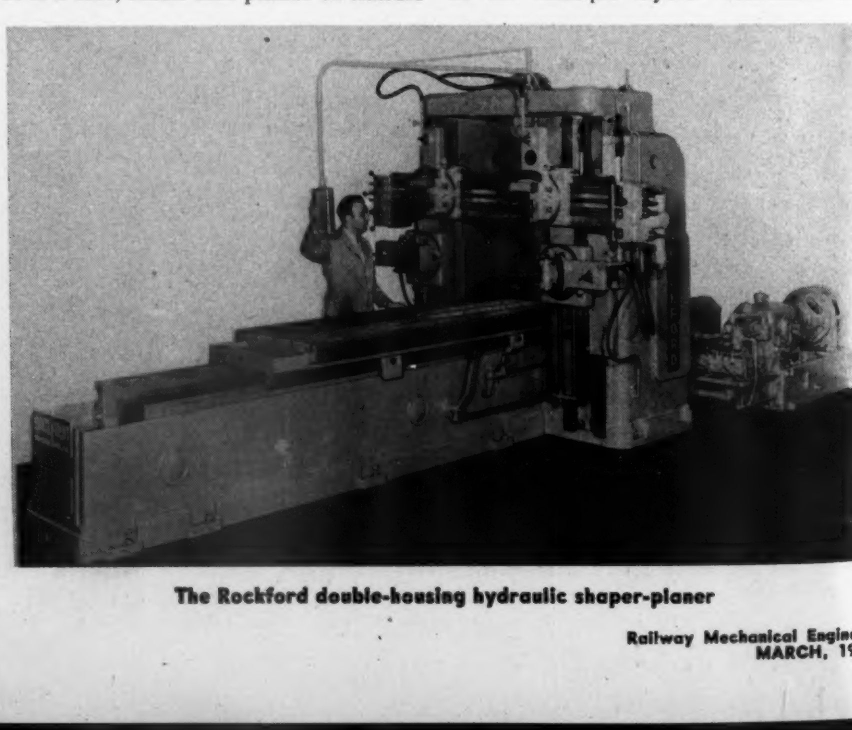
A low-hydrogen, titania-coated electrode of 2½-percent nickel composition, the type W-62 can be used on steel castings of a similar analysis and for producing weld deposits having high-impact properties at sub-zero temperatures. Its low-hydrogen coating prevents the formation of underbead cracks which frequently occur when welding hardenable steels with conventional electrodes.

Double-Housing Hydraulic Shaper-Planer

The Rockford Hydraulic shaper-planer employs hydraulic pressure for the feeds as well as the table drive. It is a fast, small-size planer to handle the production of the heavy duty in-between work that is too small for economical machining on a standard planer, yet too large for a shaper.

The shaper-planer has dual controls for the rail head and table and can be supplied with two tool heads with automatic tool lifters for the crossrail and two side heads with automatic tool lifters, the second crossrail head and side heads being extra equipment. The machine is built in three sizes: 24 in. by 24 in., 30 in. by 30 in., and 36 in. by 36 in. Stroke-length sizes of 8, 10, and 12 ft. are built in each size.

This hydraulic shaper-planer is a product of the Rockford Machine Tool Company, Rockford, Ill.



The Rockford double-housing hydraulic shaper-planer

Hard Surfacing Powder

An improved hard surfacing powder, called Surfaceweld A, has been made available by the Lincoln Electric Company, Cleveland 1, Ohio. The powder, to be applied with a carbon electrode, is used for depositing a thin chromium carbide type of hard surface that is highly resistant to abrasive wear and corrosion.

The operating characteristics of Surfaceweld A give it a wide field of application. One of its characteristics is its ability to be used with an a.c. arc with a single carbon electrode. It may also be applied with a twin carbon arc or may be used with d.c. carbon electrode negative.

Surfaceweld A is designed for surfacing applications where the use of hard surfacing electrodes is not always practical such as on thin work, thin deposits or for use with small a.c. welders.

It is also used in preference to hard surfacing electrodes for certain conditions of severe abrasion. The powder forms a paste when mixed with water which adheres to flat and curved surfaces.

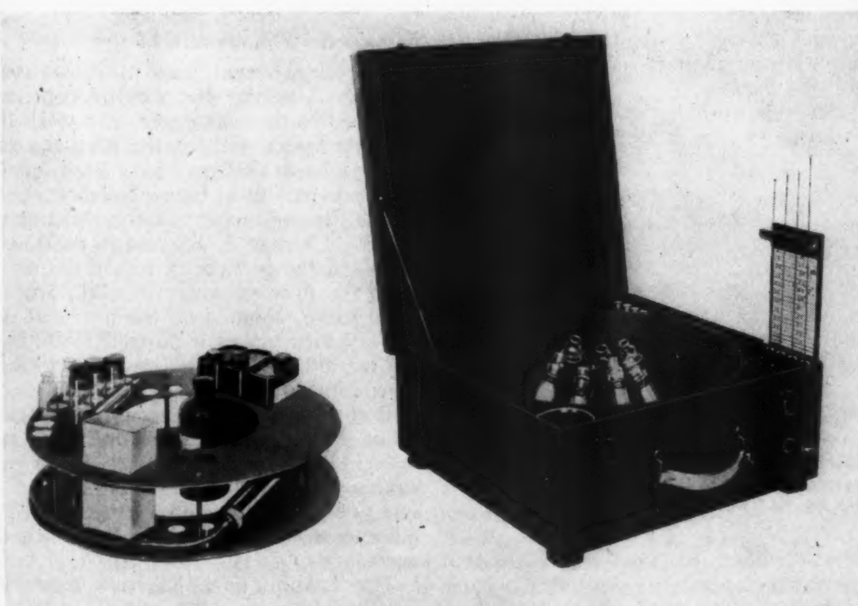
The hardness of the smooth dense deposit of Surfaceweld A is approximately 54-61 Rockwell C for one layer and 57-63 for multiple layers. Hardness de-

pends somewhat on the amount of admixture. The deposit develops full hardness in the as-deposited conditions; maintains hardness and resists scaling at elevated temperatures. Corrosion resistance is comparable to that of stainless steel.

The advantages of the powder form of hard surfacing may be put to good use on such jobs as maintaining the cutting edge of drill bits, surfacing augurs, bucket lips, forming dies, scraper blades or cable drums.

Lubricating Oil Testing Kit

To provide means for quick and simple measurements of the condition of lubricating oil, the Gerin Corporation, P. O. Drawer 653, Red Bank, N. J., has added a portable equipment kit to its line of oil testing sets. The kit measures the four dangerous classes of contaminants: 1. Change in viscosity due to fuel dilution or other causes. 2. Amount of the asphaltic and other oil breakdown substances considered responsible for deposits. 3. Amount of dirt, metal particles, other solids and water. 4. Acidity, showing whether corrosion is possible.



The Gerin portable lubricating oil testing kit

The oil from four engines can be analyzed for all four classes of contaminants in twenty-five minutes, so that changes and trends can be detected which give advance information that mechanical or operating troubles are in the making.

Abrasion Testing Equipment

For testing the wearing qualities of exterior paints and varnishes, interior finishes and seat and floor coverings, the Taber Instrument Corporation, 111 Goundry street, North Tonawanda, N. Y., has developed an abrasion testing set in which wear results from alternately rubbing the flat faces of two resilient wheels over a 4-in. specimen of the surface being tested. A range of standardized abrasive wheels are available for testing all types of surface finishes, including electroplate, porcelain enamel, organic coatings, leather, glass, plastics and woven textile fabrics.

The Taber standard abrasion-testing set

Features include a suction pump with a vertical dust receiver having a swinging nozzle fully adjustable for any thickness of specimen. As different materials require a varying degree of suction cleaning while being tested, the control unit is equipped with a built-in variable transformer for adjusting the speed of the suction turbine motor. The control panel is also equipped to provide a test period of 1,000 cycles, or less, through an adjustable timer which automatically shuts off the power and enables the operator to engage in tabulating results or preparing new specimens without being concerned about overrunning the test.

Switches on the front of the control panel make possible any combination of operating conditions, such as with or without vacuum pickup, continuous operation without timer or any timing up to 15 minutes. The control unit is equipped for dual operation so that an additional abrasion testing unit can be located beside and connected with the control unit, thereby permitting two specimens to be tested simultaneously using the same controls and vacuum unit.

Magnetic Motor Starter

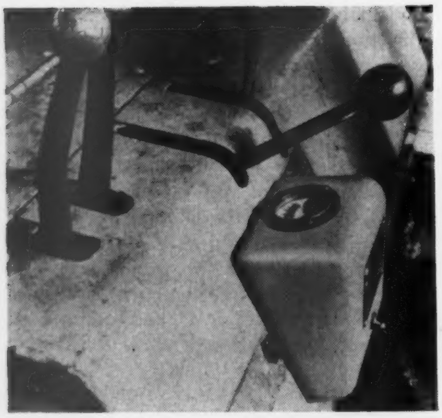
A magnetic motor starter and magnetic contactor designed to give maximum protection to alternating current motors up to 50 hp. at 440 volts, has been placed on the market by the Trumbull Electric Manufacturing Company, Plainville, Conn. Improvements claimed for the starter are longer contact life, greater protection and quiet operation. Under factory tests, the silver contacts on the starter have given clean "make and break" contacts and interruptions for millions of operations.

The starters have silver contacts and plastic-encased heater coils

Two features of the new starter and contactor are the relay heaters and the plastic-encased coil. The bi-metallic relay heaters, the maker states, will accurately follow the heating curve of the motor. The relay adjusts easily for automatic or manual reset when a lever is moved. The plastic-encased coil is intended to give greater life to the windings by protecting them from moisture, corrosion and abrasion. There is a permanent, self-lubricating composition impregnated into the plastic that will keep the magnet guides sliding smoothly and at the same time eliminate low voltage chatter.

Battery Charge Indicator

To improve industry's habits in using industrial truck batteries and to prevent battery-operation in an overdischarged condition, the Gould Storage Battery Corporation, Trenton, N. J., announces a new charge indicator. It is a dashboard mounted instrument which shows the state of discharge at any instant rather than concealing vital information until the danger zone (over-discharge) is reached. It is said to be tamper-proof and low in cost.



A battery charge indicator mounted on the dashboard of an industrial truck

The indicator is marked-off into four sections, each of a different color. Green indicates a one-half to full charge, yellow, one-quarter to one-half charge, red, zero to one-quarter charge, and pink indicates the battery is being used in an overdischarged condition. A rugged, all-aluminum case, designed for vertical mounting, houses the instrument. The gauge is read while the truck is actually in operation.

The indicator is a Wheatstone bridge type of instrument, and can be used with 3-, 6-, 12-, 15-, 16-, 18- and 24-cell batteries, a series of resistors and taps being arranged to permit the desired adjustment. A toggle switch disconnects the instrument from the battery during charge.

Dust Precipitator For Passenger Cars

A dynamic dust precipitator designed specifically for passenger car application is being made by the American Air Filter Company, Inc., Louisville, Ky. The unit, which is called the Roto-Clone, is driven by a ½-hp. motor, and serves to supply air to the car, and to separate all the larger size dust particles from the air. It is intended for use in combination with this company's Electro-Airmat electronic filter which removes small particles including smoke.

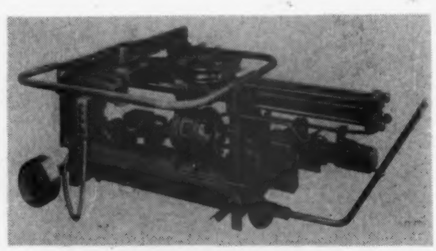
Roto-Clone dust precipitator for passenger car application

The dirt-laden air is drawn in at the central opening. As the air passes through the impeller, it is divided into numerous thin streams. The dust particles contained in these individual streams are precipitated on the blade surfaces and concentrated by centrifugal and dynamic forces. When they reach the outer edge, they are ejected into a secondary air passage which may be seen in the illustration, at one side of the clean air outlet.

Portable Ram Bender

A portable, hydraulic, ram-type bending machine, identified as the No. 1402, has been added to the line of power benders available from the Wallace Supplies Manufacturing Company, 1308 Diversey parkway Chicago 14. Equipped with standard die equipment for bending up to 2-in. extra-heavy steel pipe, it will also bend coils, return bends and special curves. Dies are available for angle iron, channels, reinforcing bars and flat bars.

No repositioning of the dies or relocating of the material is necessary when bending up to 180 deg. in one continuous operation. An initial setting of a duplicator stop will make an unlimited number of the same bends where desired.



The Wallace portable, hydraulic ram-type bending machine has a capacity for bending up to 2-in. extra-heavy pipe

The bender is push-button controlled, and a jog button is incorporated to facilitate set-ups from field measurements or bent-wire templates.

Insecticide Centrifuge

An electrically powered centrifuge, called Microsol No. 202, for breaking down insecticide material into microscopically fine particles has been produced by the Mitchell-White Corporation, New York 10. The device also distributes the insecticide fog, and the maker states that the fog particles are light enough to be airborne, and are projected in a swirling fog so that they will ride convection currents and filter into small crevices. No heat, pumps, or propellent gasses are needed. A 1/3-hp., 120-volt, universal motor is used to drive rapidly whirling discs. A combination of centrifugal forces and pressure draws the insecticide from the reservoir, reduces it to a microscopic film, and forces it across the path of a fan which provides diffusion and direction to the mist or fog. The unit weighs 11½ lb. and is equipped with a translucent nylon reservoir of one quart capacity.

Hession Microsol fog-maker for distributing insecticides

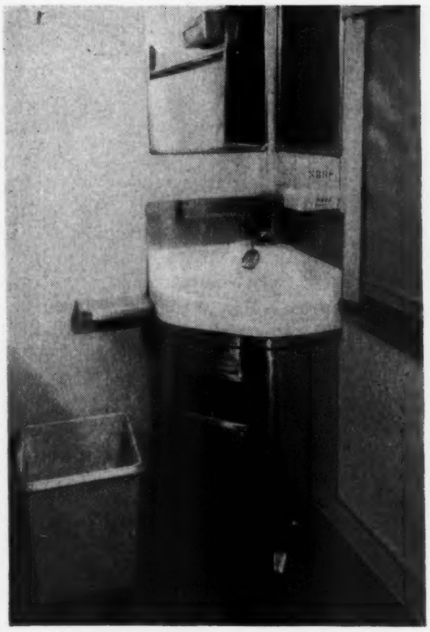
Railroad Lavatories

Two railroad-train lavatories of easy-to-clean vitreous china with controls designed so that passengers can wash in running water without the necessity of filling a basin that may have been soiled by a previous user, have been developed by the Crane Company, 836 S. Michigan avenue, Chicago 5. Known as the Lavalux and the Sanicor, a foot pedal controls the flow of water in each, and a hand valve mounted on the top shelf of the lavatory makes it possible to adjust the warmth of the running water to the most comfortable temperature.

Water is supplied through a single spout, which is equipped with a spray to prevent splashing when the water is running. A pop-up plug, with an operating handle at the back of the spout, is incorporated for filling the basin when necessary.

The Lavalux is a flat-back lavatory

The Lavalux installed in a new streamliner coach



The Sanicor corner lavatory is 17 in. by 17 in. overall

for wall mounting with overall dimensions of 18 by 15 in. The Sanicor is a corner lavatory, 17 by 17 in. overall. Both are available either in white or in a variety of colors.

Carbide Thread Chasers

Carbide-tipped die chasers with ground thread forms for selected applications on turret lathes, automatics and threading machines are available from the Jones & Lamson Machine Company, Springfield, Vt. The chasers are effective on steel as well as on hard rubber, fibre and abrasive materials which rapidly dull ordinary chasers.

On the turret lathe job illustrated, a ¾-in.-10 NC thread was cut with a tangent die head in ⅓ of a second at 2,000 r.p.m., or 400 ft. per min. A high quality finish with a class III tolerance was obtained. Carbide chasers made it possible to machine this stud complete with the spindle turning at 2,000 r.p.m. for the entire sequence of cuts, thus eliminating the need for shifting to a low speed for the threading portion of the turret-lathe operation.

Recording Vibrometer

A recording vibrometer which measures and records frequency, displacement, and wave shape of mechanical vibration, has been announced by General Electric's Special Products Division.

Built to operate either when mounted on a fixed base or held in the hands, the vibrometer weighs only 7 lb., and less than 8 in. in length. It was developed for testing all types of reciprocating and rotating machinery within a vibration frequency range of 10 to 120 cycles per second. It records both steady-state and transient vibrations.

A prod extending from one side of the vibrometer is set in motion when held against a vibrating body. This motion is amplified by a cross-spring arrangement and transmitted to a stylus which inklessly records the vibration on wax paper, thus making available a permanent record for vibration analysis of equipment. Another stylus produces a timing mark near the edge of the wax paper every one-third of a second. Both the chart speed and the interval between timing marks are governed by a synchronous motor operated from a 115-volt, 60-cycle power supply. Two push buttons are provided to give chart speeds of 1 in. and 3 in. per second.

Motion of the stylus on the chart can be observed through a window in the top of the all-aluminum case. One side

The recording vibrometer being used to check the vibration of the frame of a d.c. generator—The continuous strip chart provides a permanent record of the test

of the case can be removed easily, for rapid replacement of the wax paper roll when its 50-ft. capacity is depleted.

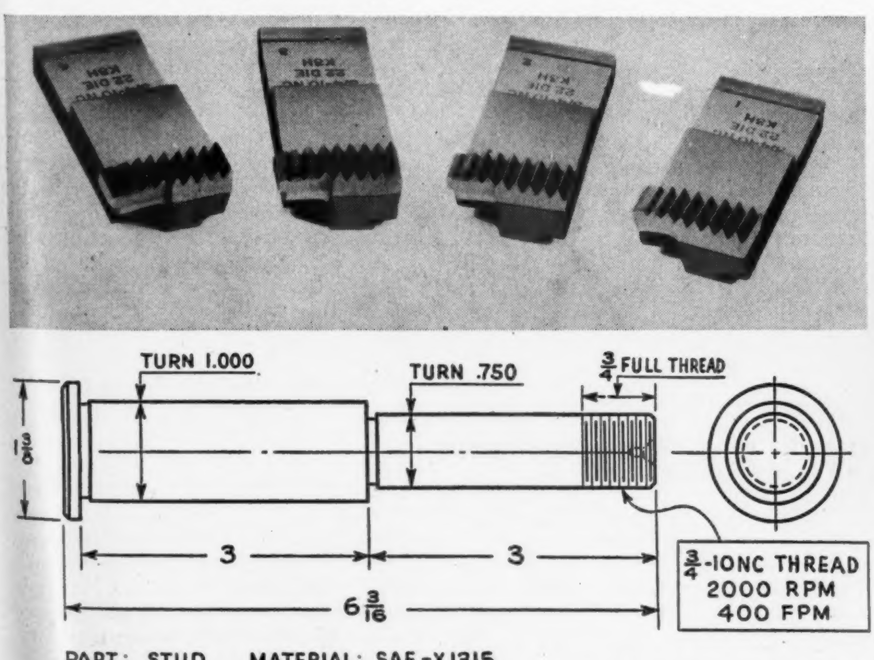
Taper-Key-Drive Spindle Nose

A standard taper-key-drive spindle nose is now being furnished in place of the threaded type on the Regal line of lathes manufactured by the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. The change-over has been affected without sacrifice of center-distance capacity of any feature of the Regal lathes. With this-type spindle nose, tapered chucks and face plates can now be interchanged among Regals, LeBlond heavy duties, and several other types of lathes.

With the taper-key-drive spindle nose, the operator merely has to line up the keyway with the key and shove "home". The loose fit of the thread in the coupling collar and on chucks or face plates per-

The taper-key-drive spindle nose which is now standard on all LeBlond Regal lathes

mits quick attachment and holds securely without binding. Safety lock-tight mountings are included to prevent chucks and face plates from flying off the spindle.



Threading operation performed on a turret lathe by carbide-tipped die chasers with ground thread forms

NEWS

A.A.R. Mechanical Division Annual Meeting in Chicago

The annual meeting of the Mechanical Division, Association of American Railroads, will be held in Chicago, June 27, 28 and 29. The sessions will be held in the Gold Room of the Congress Hotel. The opening session will convene at 10:00 a.m., June 27, and continue until 5:00 p.m. The meetings on June 28 and 29 will convene at 9:00 a.m.

Lubrication Engineers To Meet in New York in April

THE fourth annual convention of the American Society of Lubrication Engineers will be held at the Hotel Statler, New York, April 11, 12, and 13. Among the more than twenty speakers on the program will be Dr. William M. Barr, research and standards consultant of the Union Pacific, who will speak on Railway Rolling Stock Lubrication. Demonstration exhibits of lubricants, fluids, equipment, and devices covering all phases of scientific lubrication from the laboratory to the bearing will be presented at the Lubrication Show which will be held concurrently at the Hotel Statler with the convention.

Diesels Cut Use of Coal 10 Million Tons in '48

DIESEL-ELECTRIC locomotives installed by Class I railroads in 1948 displaced nearly 10 million tons of coal which would have been used as railroad fuel if coal-burning steam locomotives had performed the same proportion of the total freight, passenger, and yard service that they performed in 1947. This was shown by a recent study of the "impact of Diesel locomotives on railroad coal tonnage," made by the traffic department of the National Coal Association.

Comparing 1948 with 1944, the study showed that Diesel-electric installations of the past four years have resulted in displacement of nearly 25 million tons of fuel coal annually. The study's showing was summarized in the accompanying table. These figures were derived from calculations which divided each year's average coal consumption per service unit (gross ton-mile, passenger train car-mile, yard switching locomotive-hour) into the total of such service units lost by coal-burning steam locomotives.

Data as to service units performed by the various types of motive power were taken from compilations of the Bureau of Transport Economics and Statistics of the Interstate Commerce Commission. These showed that coal-burning steam locomotives handled 60.4 per cent of freight-service gross ton-miles during last year's first nine months, while Diesel-electrics handled 20 per cent. For the entire year 1947, the respective percentages were 67 and 12.4, while in 1944 they were 74.8 and 3.60.

In passenger service, coal-burning steam locomotives performed 36.4 per cent of the total car-miles during last year's first nine months, and Diesel-electrics performed 38.7 per cent. The respective (full-year) percentages for 1947 were 44.3 and 27.2, while in 1944 they were 60.6 and 8. Coal-burning steam locomotives performed 54.6 per cent of total yard switching locomotive-hours during the first nine months of last year, and the Diesel-electrics performed 36 per cent. Respective 1947 percentages (full year) were 58.3 and 31.8, while in 1944 they were 67 and 21.3.

Bureau of Safety Report

THE annual report of Director S. N. Mills of the Interstate Commerce Commission's Bureau of Safety for the fiscal year ended June 30, 1948, sets forth in the usual form the results of inspection of safety-appliance equipment on railroads together with information on hours-of-service of railroad employees, installation and inspection of signal systems, interlocking and automatic train-stop and train-control devices, investigation of accidents, prosecutions for violations of railroad safety laws and other activities of the bureau.

During the year under review, 1,072,504 freight cars, 23,870 passenger-train cars and 11,748 locomotives were inspected, as compared with 1,061,699 freight cars, 24,767 passenger-train cars and 12,795 locomotives in fiscal 1947. Of the 1948 total, 3.69 per cent of the freight cars, 4.13 per cent of the passenger-train cars and 4.66 per cent of the locomotives were found to be defective, as compared to the respective 1947 figures of 3.4 per cent, 3.71 per cent and 5.3 per cent.

Air brakes tested on 2,637 trains (consisting of 113,085 cars) prepared for departure from terminals were found operative on 112,958 cars, or 99.9 per cent. This percentage was attained, however, after 2,211 cars having defective brakes had been set out and repairs had been made to brakes on 1,623 cars remaining in the trains. Similar tests on 1,444 trains arriving at terminals with 77,817 cars showed that air brakes were operative on 97.5 per cent of the cars and that an average of approximately 1.3 cars per train was not controlled by power brakes.

According to the report, 696 reporting railroads and private car lines, which collectively own 2,163,051 freight cars, have equipped 1,673,353 such cars with power brakes of specifications complying with those set out in the commission's September 21, 1945, order. That order, as amended, provides that cars used in interchange service must all be equipped with the required brakes by January 1, 1950, and all other cars used in freight service must be so equipped by January 1, 1952. The figures show that 80 per cent of the railroad-owned cars, but only 58.9 of the cars owned by private car lines, were equipped as of June 30, 1948.

"Tests of geared hand brakes conducted by the Association of American Railroads during the fiscal year resulted in certification of one vertical-wheel and one horizontal-wheel brake," the report stated. "Up to June 30, 1948, 13 vertical-wheel geared brakes and 7 horizontal-wheel geared brakes had been certified by that association. Experimental road-service tests similar to the tests heretofore made of the experimental AB brake cars were conducted of the load-compensating brake on the Pennsylvania during the months of July and August, 1948."

"Human Factors in Safety"

THE National Safety Council, 20 North Wacker drive, Chicago 6, has released a new series of six sound-slide films, entitled "Human Factors in Safety", as an aid in foreman training programs. Each film deals with one aspect of the complex art of handling people. Collectively, they show how to train new workers, how to keep experienced workers alert, and how foremen can win the respect, co-operation and support of their men.

The films are 35 mm., 33-1/3 r.p.m.

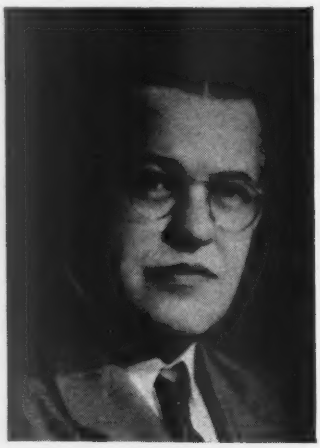
Coal Consumption Displaced by Increased Use of Diesels for Various Types of Service on Class I Roads

(Net tons)

	Total	Freight service	Passenger service	Yard switching service
1948 compared with 1947	9,705,521	5,860,810	2,872,320	972,391
1948 compared with 1946	15,102,809	8,080,848	5,707,920	1,314,041
1948 compared with 1945	19,717,492	9,501,643	8,034,540	2,181,309
1948 compared with 1944	24,843,599	12,787,277	8,797,500	3,258,822

Supply Trade Notes

SIMMONS - BOARDMAN PUBLISHING CORPORATION.—*James G. Lyne,* executive vice-president of the Simmons-Boardman Publishing Corporation, the publisher of the *Railway Mechanical Engineer,* has been elected president to succeed Samuel O. Dunn, who continues as chairman of the board. Mr. Lyne was born on July 10, 1898, in St. Louis, Mo. He received the degree of A.B. from the University of Kansas in 1920 and the degree of Ph.D. from New York



James G. Lyne

University in 1946. He began his career with the Chicago, Rock Island & Pacific at Herington, Kan., in 1914, and for fifteen months served successively as a laborer in the car department, as material clerk, timekeeper, file clerk, and M.C.B. clerk. During summer vacations while at college he served variously as extra gang timekeeper, rodman, ballast inspector, and extra clerk in the office of the superintendent of the Rock Island at Herington, and in the general enginehouse foreman's office at Kansas City, Kan. In 1919 he became a special agent in the Bureau of Labor Statistics in Washington, D.C., and in 1920, a reporter for the Daily News at New York. He became associate editor of the Railway Age (a Simmons-Boardman publication) in 1920; financial editor in 1928; assistant to editor in 1938; assistant to chairman of the Simmons-Boardman Publishing Corporation in January, 1947; co-editor of the Railway Age in October, 1947, and also executive vice-president of Simmons-Boardman in February, 1948. Mr. Lyne has been a director of the corporation since 1943.

◆

WAUGH EQUIPMENT COMPANY.—*Dan Call* has been appointed southeastern sales representative of the Waugh Equipment Company, with headquarters at Richmond, Va. Mr. Call is 38 years old. He was educated at Woodberry Forest School and the University of Virginia. After graduation in 1931, he went with the Richmond, Fredericksburg & Potomac, where he served in the car and locomotive shops as drafts-

Dan Call

man, air-conditioning supervisor, mechanical inspector and representative and as general foreman of the locomotive department. About a year ago, he established his own business as manufacturer's representative for the southeastern area.

◆

TEMPLETON, KENLY & CO.—*William E. Gahl,* who has been associated for 20 years with Templeton, Kenly & Co., Chicago, manufacturers of Simplex Jacks, has been appointed chief engineer of the company. He succeeds *F. J. Jakoubek,* who has resigned.

Mr. Gahl was born on November 20, 1904, at Chicago, and attended Armour

William E. Gahl

Institute and Morton Junior College in that city. He joined the engineering department of Templeton, Kenly & Co., in February, 1929.

◆

RAYMOND L. SMITH ASSOCIATES.—*Harry S. C. Folk,* sales engineer for the Electric Storage Battery Company for the last 30 years, has joined the staff of Raymond L. Smith Associates, New York representatives of the Automatic Transportation Company, Chicago. Mr. Folk will deal exclusively with railroads which maintain purchasing offices in eastern New York state.

WESTINGHOUSE AIR BRAKE COMPANY.—*George L. Cotter,* whose appointment as director of engineering of the Westinghouse Air Brake Company at Wilmerding, Pa., was reported in the February issue, is a graduate of the University of Michigan. He has been associated with Westinghouse Air Brake since 1923, and served in various capacities in the engineering department and in the general office until his appointment in 1929 as district engineer for the Pittsburgh (Pa.) district. In 1940 he was

George L. Cotter

appointed commercial engineer; in 1943, western district engineer at Chicago; in 1945, assistant western manager, and in March, 1947, western manager.

◆

ELECTRIC STORAGE BATTERY COMPANY.—The railway and motive power sales activities of the Electric Storage Battery Company have been combined in a new division to be known as the railway and motive power sales division. *William Van C. Brandt,* formerly manager of Exide's motive-power battery sales, has been appointed manager of the new division.

◆

INTERNATIONAL NICKEL COMPANY.—*John F. Thompson,* executive vice-president of the International Nickel Company since 1936, has been elected president to succeed *Robert C. Stanley,* who will continue as chairman of the board. *Paul D. Merica,* vice-president since 1936, has become executive vice-president. *Henry S. Wingate,* secretary since 1939, has become a vice-president and will continue as secretary.

◆

TIMKEN ROLLER BEARING COMPANY.—*Seward T. Selvage,* formerly assistant district manager in the Cleveland, Ohio, office of the Timken Roller Bearing Company, has been made sales promotion manager, with headquarters in Canton, Ohio. *T. F. Rose,* Cincinnati, Ohio, branch manager for Timken's service sales division, has become manager of

22 for the L&N

by LIMA-HAMILTON

Some pertinent data:

WE ARE NOW delivering an order of 22 locomotives of the 2-8-4 type to the Louisville and Nashville Railroad Co.

Modern steam locomotives like these will show a good return on their investment. With planned scheduling, they can deliver more ton-miles of freight per dollar of investment than any other type of locomotive.

Class M-1
Service: Freight
Road Nos.: 1970-1991
Tractive Force, with Booster: 79,290 lb.
Cylinders: 25" x 32"
Drivers, Diameter: 69"
Weight on Drivers: 267,500 lb.
Weight on Front Truck: 52,900 lb.
Weight on Trailing Truck: 127,700 lb.
Total Weight of Engine: 448,100 lb.
Fuel: Soft Coal
Grate Area: 90 sq. ft.
Steam Pressure: 265 lb.
Tender Capacity: 22,000 gal., 25 tons

LIMA HAMILTON CORPORATION

DIVISIONS: *Lima, Ohio*—Lima Locomotive Works Division; Lima Shovel and Crane Division. *Hamilton, Ohio*—Hooven, Owens, Rentschler Co.; Niles Tool Works Co. *Middletown, Ohio* — The United Welding Co.

PRINCIPAL PRODUCTS: Locomotives; Cranes and shovels; Niles heavy machine tools; Hamilton diesel and steam engines; Hamilton heavy metal stamping presses; Hamilton-Kruse automatic can-making machinery; Special heavy machinery; Heavy iron castings; Weldments.

Timken Roller Bearing Service & Sales, Ltd., Toronto, Ont. Mr. Rose succeeds the late *C. E. Webster*. He is succeeded at Cincinnati by *H. C. Telford,* formerly assistant manager of the Timken branch in Atlanta, Ga.

◆

GENERAL AMERICAN TRANSPORTATION CORPORATION.—*The General American Transportation Corporation* has moved from 209 W. Jackson boulevard to 131 South Wabash avenue, Chicago 2, its field erection division; its engineering department, and the purchasing department for its plate and welding, process equipment and plastics divisions.

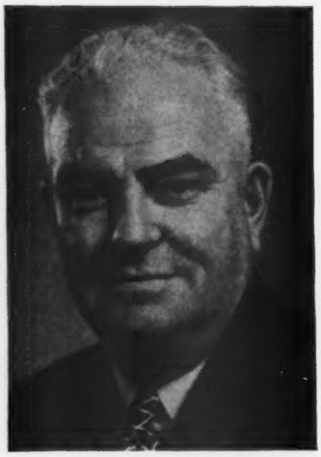
◆

AMERICAN LUMBER & TREATING CO. —The American Lumber & Treating Co. has opened new sales offices in Philadelphia, Pa., and Baltimore, Md. *J. P. Johnson, Jr.,* formerly at the company's Washington, D. C., office, has been appointed sales representative in Philadelphia, and *W. E. Wilkins,* recently in the New York sales department, has been appointed sales representative in Baltimore. Both men will work under the direction of C. D. Bird, district manager in Washington.

◆

GENERAL MOTORS CORPORATION, ELECTRO-MOTIVE DIVISION.—*Andrew G. Finigan,* formerly superintendent of the locomotive division, Electro-Motive Division of General Motors Corporation, La Grange, Ill., has been appointed manager of the firm's new plant No. 3 at Cleveland, Ohio.

Mr. Finigan, prior to his association with Electro-Motive in 1923, served as a toolmaker at the General Electric Company in Schenectady, N. Y. In 1908 he became a member of the crew which subsequently built the original G. E. gasoline-electric rail cars. Later, after G. E. abandoned construction of rail cars, he became an automobile dealer at Erie, Pa. He then joined Electro-Motive at Cleveland. He became superintendent of the locomotive division at La Grange in 1935.



Andrew G. Finigan

◆

ERNEST KUEHN, formerly Pacific Coast regional manager for the Electro-Motive Division of General Motors Corporation, and more recently an adviser to the firm, has retired. Mr. Kuehn first entered service with the company in 1923, when it was known as the Electro-Motive Engineering Corporation. Before that he worked for the General Electric Company when it was producing rail cars, and for the St. Louis Southwestern as superintendent of motor cars. In 1936 he was appointed factory manager at La Grange, Ill. In 1942, for reasons of health, he became special representative of a General Motors' vice-president. He was appointed Pacific Coast regional manager in 1944. In July, 1948, he relinquished that post, but remained with the firm in an advisory capacity until January 1, 1949.

Ernest Kuehn

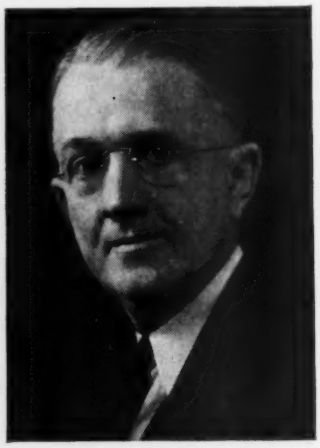
◆

BAKER RAULANG COMPANY, *W. B. Landers,* 702 M & M building, Houston 2, Tex., has been appointed district sales representative in southeast Texas of the Baker industrial truck division of the Baker-Raulang Company.

◆

HUNT-SPILLER MANUFACTURING CORPORATION.—*E. J. Fuller,* executive vice-president and general manager of the Hunt-Spiller Manufacturing Corporation, has retired.

Mr. Fuller was born in Clinton, Iowa, in 1883. He began his career as a machinist apprentice in the employ of the Chicago & North Western, at Clinton, and continued there as machinist after completing his apprenticeship. Later, he was appointed to a supervisory position in the mechanical department. From 1911 to 1913 he was chief inspector of



E. J. Fuller

Diesel switchers of 600 and 1,000 hp. are now being built at the rate of one each working day at the new Cleaveland, Ohio plant of the Electro-Motive Division, General Motors Corporation.—The plant, which was purchased from the Navy last year as noted in the September, 1948, issue, page 533, is devoted exclusively to the manufacture of switching locomotives

new equipment for the C. & N. W., at the Schenectady, N.Y., plant of the American Locomotive Company. He became mechanical representative for Hunt-Spiller in 1914; assistant sales manager in 1927, and sales manager in 1928. Mr. Fuller was elected executive vice-president in 1936, and also general manager in 1942.

◆

CLARK EQUIPMENT COMPANY.—The Bond Industrial Equipment Company, 51 Clarkson street, New York, has been appointed distributor of the complete line of Clark Fork-Lift trucks and industrial towing tractors.

◆

GENERAL AMERICAN TRANSPORTATION CORPORATION.—*F. E. Cheshire*, formerly vice-president of the Chicago, Indianapolis & Louisville, has been appointed sales engineer of the General American Transportation Corporation. Mr. Cheshire, in his new post, recently departed by air for the Far East.

◆

CORDLEY & HAYES.—*William J. Mays* has been elected a vice-president, and *H. Douglas Chisholm* secretary of Cordley & Hayes.

◆

ERWIN J. SCHMIDT, sales manager of the railway division of the Dayton Rubber Company, Dayton, Ohio, has resigned.

◆

AMERICAN BRAKE SHOE COMPANY.—*Harry D. Sweeney*, sales engineer of the American Brake Shoe Company, has been appointed sales manager of welding products for the American manganese steel division, with headquarters as before in Chicago Heights, Ill.

Mr. Sweeney has been associated with

Harry D. Sweeney

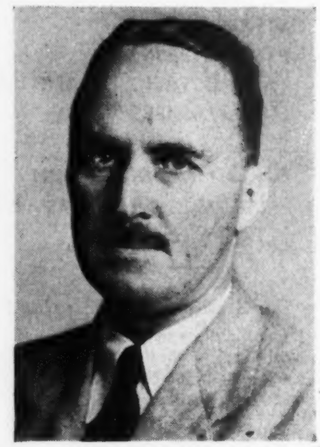
American Brake Shoe since 1945. He was formerly with the Acme Steel Company and during World War II served as a first lieutenant with the United States Army in England and France.

◆

PYLE-NATIONAL COMPANY.—*Ralph B. Black* has been appointed district manager of the Pyle-National Company, with headquarters in the Chronicle build-

ing, at Houston, Tex., with jurisdiction over the company's operations in Texas, Oklahoma, New Mexico, Colorado, and that part of Louisiana west of the Mississippi River.

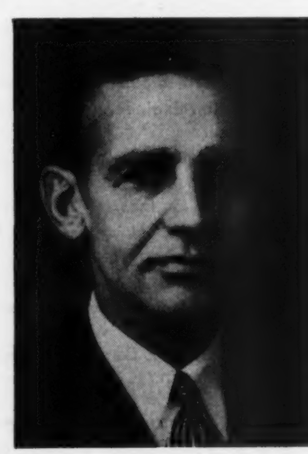
Mr. Black has until recently been associated with the R. P. Devine Construc-



Ralph B. Black

tion Company at Sterling, Ill. He was born at Denver, Colo., and is a graduate of the University of Colorado. He served as a consulting engineer in Houston from 1934 to 1942, and then spent 4½ years in the U. S. Army Engineers Corps during World War II, being discharged as a major.

GENERAL ELECTRIC COMPANY.—*John J. Huether,* manager of the transportation division of the General Electric Company since April, 1948, has been appointed also manager of the central station division to succeed *Ralph M. Darrin,* who has been elected a commer-



John J. Huether

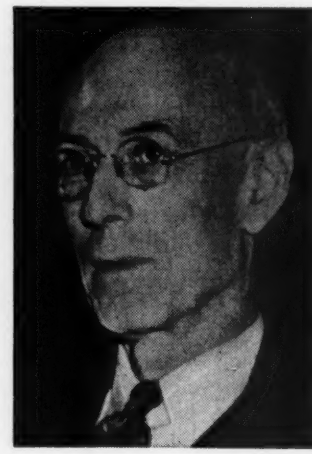
cial vice-president and assigned to customer relations work in the New England territory.

Mr. Huether is a graduate of Notre Dame University (1922) with a degree in electrical engineering. After graduation he joined General Electric's test course as a student engineer. A year later, he was assigned to the alternating current engineering department. He transferred to the steel mill section of

the industrial department in 1924; was appointed manager of sales in the machinery manufacturers section in 1931, and manager of the mining and steel mill section of the industrial department in 1937.

◆

AMERICAN LOCOMOTIVE COMPANY.—*Sherman Miller,* vice-president in charge of production engineering of the American Locomotive Company at Schenectady, N.Y., has been appointed consultant to the Locomotive Division. R. J. Finch, chief mechanical engineer, has assumed direct supervision of the engineering department and will report to the manager of the Locomotive Division.



Sherman Miller

Mr. Miller began his career in 1895 in the erecting shop of the Brooks Locomotive Works, a predecessor of the American Locomotive Company, at Dunkirk, N.Y. Four years later he transferred to the Brooks Drawing room. He studied mechanical engineering at Purdue University (class of 1905) and in 1907 was transferred from the drawing room at Dunkirk to Schenectady. In 1916 he was appointed superintendent of the general drawing room and, in 1941, chief mechanical engineer. In 1946 he was elected vice-president.

◆

COMBUSTION ENGINEERING - SUPERHEATER, INC.—Included among the officers of this company, which is a merger of the Combustion Engineering Company and the Superheater Company as noted on page 124 of the February issue, are *Bard Browne,* vice-president; *R. J. Van Meter,* vice-president, and *F. J. Dolan,* assistant secretary.

◆

BLACK & DECKER MANUFACTURING CO.—The Black & Decker Manufacturing Co., Towson, Md., has removed its Chicago sales and service station to a new building at 1100 W. Jackson boulevard. *R. G. Horner* is branch manager. *James F. Moore,* service engineer at Chicago, is now sales engineer at Chicago. *T. J. Waters* succeeds Mr. Moore as service engineer. *W. E. Boyles,* serv-

A BIG OK ON THE KATY

IN April 1947, the Missouri-Kansas-Texas Railroad placed General Motors passenger locomotive No. 101 in service. Through June 1948, this 4,000 H.P. Diesel met assignments 100%.

The record of General Motors Diesels in freight service on the Katy is equally brilliant. As shown by the performance table below, seven General Motors Diesel freight locomotives in their first year of operation rolled up a total of 1,130,156 miles out of 1,144,376 miles assigned. Operating on fast daily schedules between Oklahoma, Texas and the North, they handled crack Katy freights an average of 13,697 miles per month, with a record of 98.76% availability based on assignment.

PERFORMANCE OF GM DIESEL FREIGHT LOCOMOTIVES ON M-K-T

Loco. No.	Month Delivered	Total Miles Assigned	Total Miles Operated	Avg. Miles Operated Per Month	Per Cent of Assignment Filled
201	6-47	164,012	161,538	12,996	98.49
202	6-47	172,715	170,453	13,746	98.69
203	7-47	160,689	158,716	13,742	98.77
204	7-47	163,776	162,335	13,934	99.12
205	7-47	161,408	159,468	13,771	98.80
206	7-47	162,578	161,130	14,036	99.11
207	7-47	159,198	156,516	13,705	98.32
	TOTAL	1,144,376	1,130,156	13,697	98.76

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS • LA GRANGE, ILL. • *HOME OF THE DIESEL LOCOMOTIVE*

ice engineer at New Orleans, La., has been transferred to Cleveland, Ohio, as sales engineer, and *R. B. McClellan* succeeds Mr. Boyles as service engineer at New Orleans. *Thomas Rogers* has been promoted to the position of sales engineer at Dallas, Tex.

◆

NEWHALL-MARSHALL-WOOD. — *David Newhall, John S. Wood* and *Charles A. Marshall* have incorporated under the firm name of Newhall-Marshall-Wood, with offices at 30 Church street, New York 7, to engage in purchase and sale of surplus, obsolete and scrap railroad cars, locomotives, parts, and other kinds of equipment.

◆

BUDD COMPANY.—Negotiations are under way between the government and the Budd Company for the purchase of the Red Lion plant at Philadelphia, Pa.

Edwin F. Bates, works manager of the Red Lion plant has been appointed plant manager, and *Lee N. Blugerman,* assistant works manager, has been appointed works manager.

◆

BALDWIN LOCOMOTIVE WORKS.—*D. R. Staples* has been appointed manager of the Diesel locomotive engineering department of the Baldwin Locomotive Works, and *Ralph A. Miller* has been appointed section manager, electrical section, of the same department.

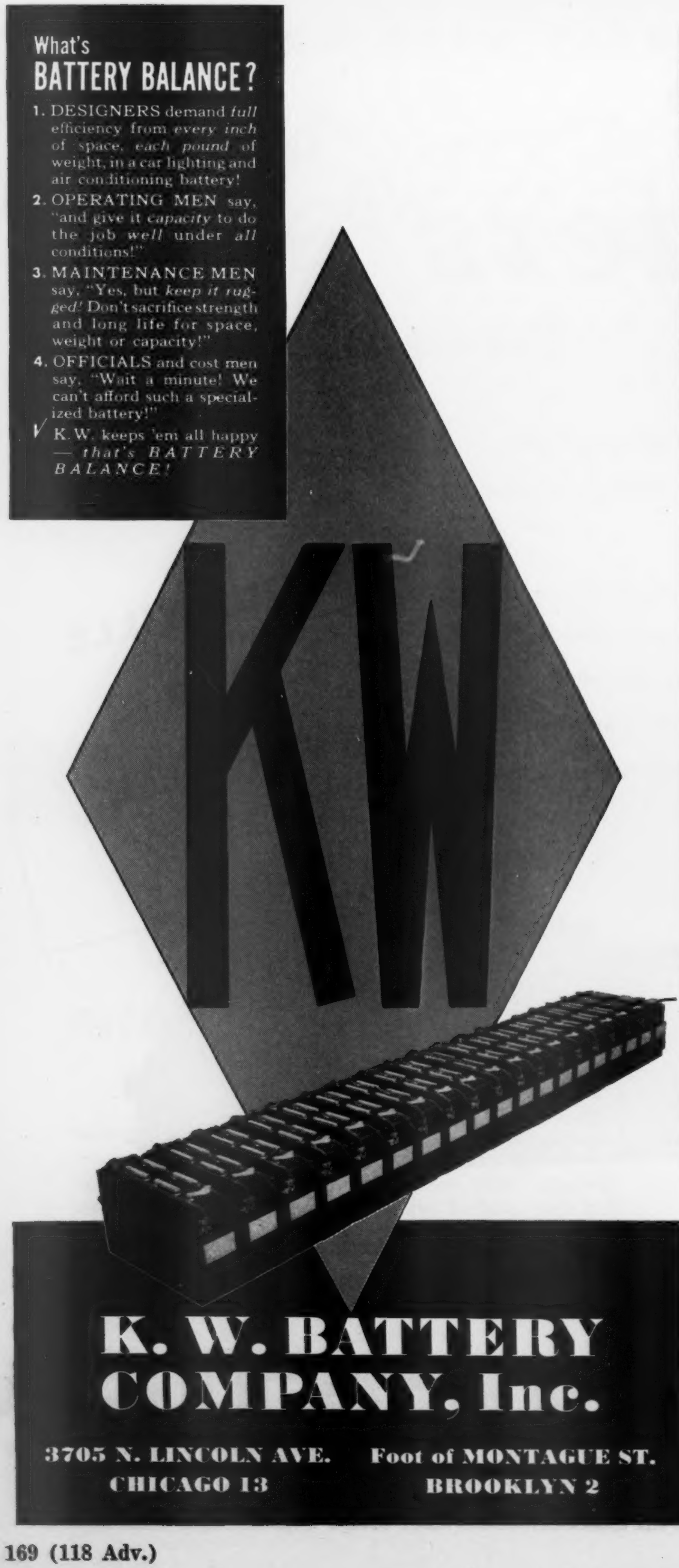
◆

MORTON GRERORY CORPORATION, NELSON STUD WELDING DIVISION. — The Victor Equipment Company, San Francisco, Calif., has been appointed as exclusive distributor for Nelson Stud Welding equipment and products in the Pacific coast area. The distributorship will cover both sale and rental of Nelson Stud welding guns and control units, and sale of Nelson flux-filled studs and other fasteners in California, Oregon, Washington, Nevada and Idaho.

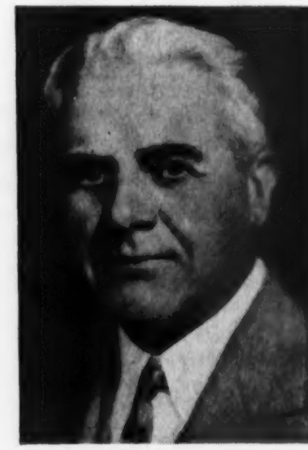
◆

AMERICAN STEEL FOUNDRIES— *Thomas Drever,* president of American Steel Foundries since January 19, 1939, has been elected chairman of the board. *C. C. Jarchow,* vice-president, with general executive duties, since January, 1947, has been elected president to succeed Mr. Drever. *C. E. Grigsby,* formerly assistant vice-president, has been elected a vice-president.

Mr. Drever was born on May 2, 1882, in Edinburgh, Scotland, and was educated at the Royal High School there. He began his business career as a chartered accountant in Scotland in 1905. Later in the same year he came to New York, where he was a certified public accountant until 1907. He then moved to Boston, Mass., and on April 28, 1910, joined American Steel Foundries as controller. Mr. Drever resigned this position on November 6, 1924, to assume the presidency of the Wahl Company, now Eversharp, Inc. He rejoined American Steel Foundries, as secretary and treasurer, on March 7, 1929, at which time he



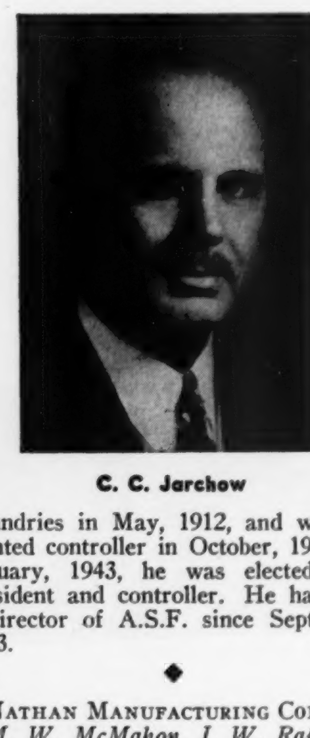
was elected also a member of the board of directors. Three years later he was elected vice-president and treasurer. Mr. Drever is also chairman of the Griffin Wheel Company and a member of the



Thomas Drever

governing boards of the Railway Business Association and the National Industrial Conference Board.

Mr. Jarchow was born in Chicago in 1894. He is a certified public accountant of Illinois. He joined American Steel



C. C. Jarchow

Foundries in May, 1912, and was appointed controller in October, 1924. In January, 1943, he was elected vice-president and controller. He has been a director of A.S.F. since September, 1943.

◆

NATHAN MANUFACTURING COMPANY. —*M. W. McMahon, J. W. Rapp,* and *Joseph Schultz, Jr.,* have become members of the Nathan organization, working out of Buffalo, N.Y.; Roanoke, Va., and Albany, N.Y., respectively, under the jurisdiction of W. S. Harris, eastern district manager. *D. M. Vance,* another new member of the company, is working out of San Antonio, Tex., under C. J. Banning, western district manager. Mr. McMahon was formerly assistant master mechanic at the Syracuse, N.Y., terminal of the New York Central System; Mr. Rapp was previously with the Locomotive Firebox Company; Mr. Schultz was formerly with the American Locomotive

Company, and Mr. Vance was formerly assistant vice-president, motive power and machinery, of the Southern Pacific of Mexico.

◆

HAMMOND MACHINERY BUILDERS, INC.—*Henry J. Kingsbury,* chief engineer of Hammond Machinery Builders, Inc., Kalamazoo, Mich., has retired from that position after 50 years of service with the company. He continues with the firm in engineering research and development.

◆

GRIFFIN WHEEL COMPANY.—*Herbert J. Rosen,* whose election as president of the Griffin Wheel Company, Chicago, was reported in the February issue, was born at Brooklyn, N.Y., on February 12, 1885. He entered the service of Griffin

Herbert J. Rosen

Wheel on July 2, 1900, and has remained with the company continuously since that time. He was elected a vice-president and director in December, 1943, and was serving as executive vice-president at the time of his election as president.

Ernest P. Waud, whose election as chairman of the executive committee,

Ernest P. Waud

Griffin Wheel Company, Chicago, was reported in the January issue, was born on April 10, 1882, in London, England, and came to the United States with his parents in 1891. He attended St. Paul's Cathedral School at Garden City, N.Y.,

NOW · · the Multi-Purpose PYLE GYRALITE for Locomotives!

Most Effective Beam Pattern · · Greatly Simplified Mechanism · · Only <u>ONE</u> Lamp · · <u>ONE</u> Reflector · · <u>ONE</u> Motor

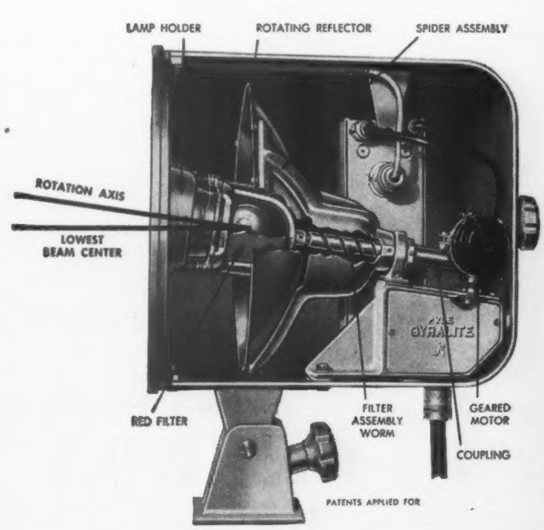
MULTI-PURPOSE GYRALITE . . . with automatic color change. 16-inch reflector. 18-inch door glass. For built-in mounting on diesel locomotives.

The mechanism and construction of the Multi-Purpose Gyralite is very simple and economical, with a minimum of moving parts, assuring exceptional reliability. There is only *one lamp . . . one reflector . . .* and *one motor!* The gyration of the beam is achieved by the rotation of the reflector which is directly connected to the shaft of the geared motor. The automatic color change is simply effected by reversing the direction of the motor. Since the motor and lamp-holder are stationary, there are no moving lead wires. Greatly simplified wiring utilizes only one relay switch, and all internal connections are factory made.

The Multi-Purpose Gyralite automatically projects a red "gyrating" beam when the train is slowing or stopping in emergencies, night or day. Manual control provides for a clear gyrating light to warn motorists approaching grade crossings, or a stationary clear light which serves as an excellent bright or dim auxiliary headlight.

A line of Single-Purpose Gyralites (without automatic color change) designed for portable rear-car mounting and for permanent mounting on both front and rear ends of trains, operate automatically or by manual control as red gyrating lights to warn overtaking or on-coming trains in emergencies.

Over half a century of specialized experience in railway lighting equipment has aided the Pyle-National Company in the development and manufacture of this new complete line of warning projectors. The Pyle Gyralites project a continuously moving, highly concentrated light beam which "gyrates" in a conical pattern. The center line of the beam is aligned parallel with the track at the lowest point in its gyrating path. Thus, approaching trains intercept the full intensity of the light at the bottom of each sweep and in all other positions the beam is projected above the horizon, producing continuous sky effect with maximum elevation . . . Never is the beam projected toward the ground where the light is wasted and its reflection is disturbing to the vision of the locomotive crew. Write for Gyralite Bulletin with complete operating and specification details.



MULTI-PURPOSE GYRALITE—Reflector in position to project beam on lowest center, parallel to track. Color filter forward enclosing lamp for red beam. Patents Pending.

SINCE 1897

THE PYLE-NATIONAL COMPANY

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BRANCH OFFICES and AGENTS in the principal cities of the United States and Canada. EXPORT DEPARTMENT: International Railway Supply Company, 30 Church Street, New York. CANADIAN AGENT: The Holden Company, Ltd., Montreal.

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and Cornell University. He entered the service of Griffin Wheel on May 1, 1905, and advanced through successive positions to that of president on December 3, 1937. Mr. Waud is a director of the firm, and also of American Steel Foundries, the Union Special Machine Company, the Pyle-National Company, and the Ideal Roller & Manufacturing Co.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*C. H. Bartlett* has been appointed manager of power transformer sales of the Westinghouse transformer division of the Westinghouse Electric Corporation, at Sharon, Pa. Mr. Bartlett has been manager of the specialty transformer department since he organized it in 1945.

◆

ULSTER IRON WORKS. — *Harold W. Lahey* has been elected chairman of the board of directors of the Ulster Iron Works, and *Frank W. Hamilton, Jr.*, a vice-president, has been elected president to succeed his father, whose death was reported in the January issue.

◆

AIRETOOL MANUFACTURING COMPANY.—During the past year, three new branch offices have been opened by the Airetool Manufacturing Company of Springfield, Ohio. The first was opened in Philadelphia, Pa.; the second, in Baton Rouge, La., and the third, in Tulsa, Okla. *James M. Brown*, representative who had been in charge of the Baton Rouge office since it was opened in May, 1947, was given the Tulsa assignment when that office was started late in 1948. Mr. Brown, who came to the company in May, 1946, acted as company representative serving dealers' customers in Ohio and adjoining states for a year before going to Baton Rouge. He was succeeded in that district by *M. E. Segraves*. As manager of the new Tulsa branch, Mr. Brown will serve customers in Oklahoma, North and West Texas, and eastern New Mexico. He will also be available for service calls in Kansas.

The Philadelphia branch office remains in charge of *Herbert Russell*.

◆

FAIRBANKS, MORSE & CO. — *O. O. Lewis*, assistant sales manager, has been appointed sales manager of Fairbanks, Morse & Co. *Harry L. Hilleary*, for the past 17 years manager of the St. Louis, Mo., branch, has been transferred to Chicago as assistant sales manager. *L. A. Weom*, manager of the pump division, has been transferred to St. Louis as branch-house manager, succeeding Mr. Hilleary, and *Donald T. Johnstone*, assistant manager of the pump division, succeeds Mr. Weom as manager of the division.

◆

KENNAMETAL INC.—*Carroll Edgar* has been appointed a representative of Kennametal Inc., in the Seattle, Wash., area, with headquarters at 2727 First avenue, south. *John D. Cook* has been appointed application engineer in the

midwestern district, with headquarters at Chicago, to succeed *William L. Chambers,* who has been transferred to the Pittsburgh, Pa., district office.

◆

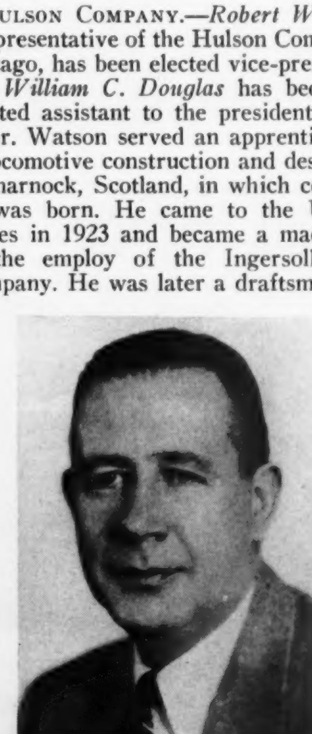
AMERICAN CAR & FOUNDRY COMPANY.—*Nelson C. Walker,* assistant district manager of the Berwick, Pa., plant of the American Car & Foundry Company, has been appointed district manager of that plant, to succeed Justus W. Lehr, who has been granted an extended leave of absence.

N. C. Walker

◆

HULSON COMPANY.—*Robert Watson,* a representative of the Hulson Company, Chicago, has been elected vice-president, and *William C. Douglas* has been appointed assistant to the president.

Mr. Watson served an apprenticeship in locomotive construction and design at Kilmarnock, Scotland, in which country he was born. He came to the United States in 1923 and became a machinist in the employ of the Ingersoll-Rand Company. He was later a draftsman for the American Locomotive Company. In 1925 he became chief draftsman for the Erie in Cleveland, Ohio; in 1929, mechanical and sales engineer for the Firebar Corporation, and in 1932, sales engineer and western sales manager for the Waugh Equipment Company. From 1938 to 1941, Mr. Watson was employed



Robert Watson

STRIPPING TWO CAR WHEELS SIMULTANEOUSLY AT N.Y.O. & W.R.R. SHOPS, MIDDLETOWN, N Y.

PLACING GEAR PROTECTOR PREPARATORY TO STRIPPING DIESEL WHEEL

by Manning, Maxwell & Moore. In the latter year he returned to Waugh Equipment as assistant to the president and vice-president, and in May, 1948, joined the railway equipment division of the American Welding & Manufacturing Co. Several months later he became associated with the Hulson Company.

Mr. Douglas was previously assistant vice-president—freight traffic of the New York Central at Chicago.

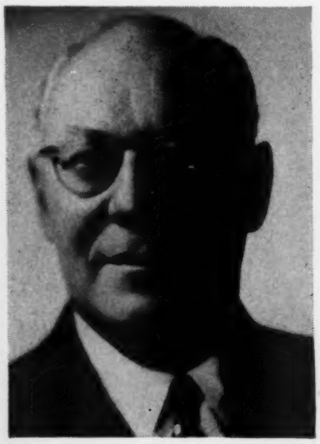
◆

SKF INDUSTRIES.—*Stuart H. Smith,* formerly assistant district manager of the Detroit, Mich., office of SKF Industries, has been appointed Cincinnati, Ohio, district manager. The following have been appointed field representatives: *C. N. Benson* and *D. B. Eden,* Boston, Mass.; *A. R. Ehrnschwender,* Cincinnati; *J. T. Paradise,* Atlanta, Ga., and *G. L. Hansen,* Portland, Ore.

◆

UNION ASBESTOS & RUBBER COMPANY.—*W. H. Fehrs* has been appointed a vice-president of the Union Asbestos & Rubber Company, with headquarters in the company's main office in Chicago.

Mr. Fehrs, before joining the Union Asbestos & Rubber Company in May,



W. H. Fehrs

1928, had been employed in the mechanical engineering department of the Union Pacific at Omaha, Neb., for 12 years. He was a member of the railroad sales department of Union Asbestos until 1932, when he became manager of automotive sales. In 1939 he was appointed assistant to the vice-president. Later in 1939 he became manager of the company's Cicero, Ill., plant.

◆

REED ROLLER BIT COMPANY, CLECO DIVISION.—*B. O. Stoothoff* has been appointed special representative of the Cleco Division of the Reed Roller Bit Company, with headquarters at 431 Temple Bar building, Cincinnati, Ohio. Mr. Stoothoff will act as liaison between the general sales office in Houston, Tex., and local dealer organizations.

◆

AMERICAN STEEL & WIRE COMPANY.—The American Steel & Wire Company, a subsidiary of the United States Steel Corporation, has established a separate stainless-steel sales division, to be

known as the stainless steel products sales division. *Banks E. Eudy* has been appointed manager of the new division and *C. Richard Horwedel* has been appointed assistant manager.

◆

HELI-COIL CORPORATION.—*Walter D. DeLamater* has been elected a vice-president of the Heli-Coil Corporation of Long Island City, N. Y.

◆

CHARLES A. LYNN, sales representative for E. I. du Pont de Nemours & Co., with headquarters at Philadelphia, Pa., has retired. Mr. Lynn joined du Pont in 1917 as a correspondent for industrial and railway sales in the Philadelphia office. Since 1922 he has been a sales representative, specializing in paints, varnishes, enamels and lacquers for railroads.

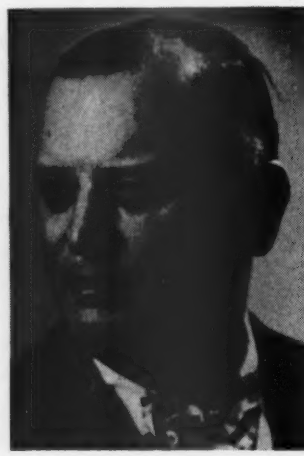
◆

VAPOR HEATING CORPORATION.—The Vapor Heating Corporation, Chicago, has opened an office at Houston, Tex., in charge of *J. T. Elwood,* who was formerly located at St. Louis, Mo.

Obituary

WALTER C. SANDERS, general manager, Railway Division, Timken Roller Bearing Company, died on February 13 in the Altman Hospital, Canton, Ohio, after an illness of two weeks. Mr. Sanders was born on February 4, 1893, in Cedartown, Ga. He attended the Cedartown High School and Mercer University (1915) and was a licensed mechanical engineer in New York and Ohio. He began his career as an apprentice machinist in the locomotive shops of the Central of Georgia at Cedartown in 1908. In 1912 he became sub-foreman and shop draftsman, locomotives and cars, at the Macon (Ga.) shops. In 1915 he was employed by the Bibb Manufacturing Company at Macon as a machinist and draftsman. In 1916 he went to Waycross, Ga., as a machinist in the locomotive repair shops of the Atlantic Coast Line. Later in 1916 he was assigned to mechanical engineering work in the office of the general superintendent of motive power of the A.C.L. at Wilmington, N.C. In 1917 he was commissioned a lieutenant in the U.S. Army. He served with the Artillery in France until after the armistice, when he served with the 18th U.S. Engineers and Division of Construction at Bordeaux. Upon his return to the United States he was assigned to the Artillery Training Center at Fort Monroe, Va., to help make a study of railway artillery operations in the United States. During 1918-19 he prepared courses and instructed artillery student officers of West Point. Mr. Sanders returned to railroad work in 1920 as leading car draftsman, designer and special engineer in the rolling stock division of the equipment engineering department of the New York Central at New York. He became associated with the Timken Roller Bearing Company in 1923 as engineer of railway equipment and was

appointed general manager, Railway Division, in 1927. Mr. Sanders had been admitted to practice law before many U.S. and State courts, including the U.S. Supreme Court. He was a lieutenant colonel in the U.S. Army Reserve Corps and had been commended by the assistant secretary of war for the preparation of a General Transportation Plan for a National Emergency for the War Department. He held memberships in many associations, including the



W. C. Sanders

Railway Supply Manufacturers' Association, of which he had been an executive committee member and chairman of the Export Committee. He had served on the General Committee of, and as chairman of the Executive Committee of the Railroad Division, American Society of Mechanical Engineers.

Personal Mention

General

George A. Howard, general inspector, shop methods, of the Canadian National at Montreal, Que., has been appointed as mechanical engineer, shop methods, with headquarters at Montreal.

Rollin J. Chinn, general foreman of the Illinois Central at Memphis, Tenn., has been appointed assistant to the general superintendent of equipment with headquarters at Chicago.

C. O. Butler, master mechanic of the Atlantic Coast Line at Rocky Mount, N. C., has been appointed superintendent motive power, western division, with headquarters at Fitzgerald, Ga.

Chicago Great Western

The following changes have been made in the operating department of the Chicago Great Western at Oelwein, Iowa, resulting from the merger of the locomotive and car departments: *T. Olson,* superintendent of motive power, has been appointed superintendent of motive power and equipment, and *L. E. Hil-*

sabeck, superintendent of the car department, has been appointed supervisor of car equipment.

R. H. Marquat has been appointed general superintendent motive power and equipment of the Illinois Terminal, with headquarters in St. Louis, Mo.

Harry S. Marsh, whose appointment as superintendent—car department, of the Missouri Pacific at St. Louis, Mo., was reported in the February issue, was born on May 10, 1898, at Carlyle, Ill. He began his railroad career in August, 1915, as a car clerk in the employ of the Chicago & North Western and later served in various positions in the car department until May, 1917, when he entered the United States Army as a cavalryman. In September, 1919, he returned to the car department of the C. &

Harry S. Marsh

N. W. In November, 1924, he became assistant foreman for the M. P. at De-Soto, Mo. He was subsequently advanced through various positions to that of passenger car foreman at North Little Rock, Ark., in March, 1935, and to general car inspector at St. Louis in 1936. Mr. Marsh was appointed general freight and passenger-car foreman at North Little Rock in September, 1940, general car inspector at St. Louis in May, 1941, and assistant superintendent—car department at St. Louis in August, 1947.

Charles Ormonde Butler, master mechanic of the Atlantic Coast Line at Rocky Mount, N.C., has been appointed superintendent of motive power with headquarters at Fitzgerald, Ga. Mr. Butler was born on May 7, 1897, at Wilmington, N.C., and is a graduate in mechanical engineering of North Carolina State College in 1922. He entered the service of the A. C. L. in June, 1922. In August, 1922, he went to Columbia University for special training, returning to the A.C.L. at Wilmington as machinist in January, 1923, and transferring to Waycross, Ga., the following month. Mr. Butler became shop inspector in November, 1923; machinist on March 1, 1933; lead man on March 16, 1936; gang foreman on October 4, 1937. On July 1, 1938, he became night engine-

house foreman at Lakeland, Fla.; on June 16, 1939, day enginehouse foreman, and on August 1, 1941, general foreman. Mr. Butler entered military service in July, 1942, returning to the A.C.L. on December 28, 1946, as master mechanic at Florence, S.C., and transferring to Rocky Mount, N.C., on March 1, 1948.

D. L. Borchert has been appointed assistant mechanical superintendent of the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Minneapolis, Minn.

E. J. Haley, Jr., enginehouse foreman of the Atlantic Coast Line at Rocky Mount, N.C., has been appointed general mechanical inspector, with headquarters at Wilmington, N.C.

C. F. Guggisberg, assistant mechanical superintendent of the Minneapolis, St. Paul & Sault Ste. Marie at Minneapolis, Minn., has been appointed mechanical superintendent at Minneapolis.

Car Department

Reed Haag, general foreman of the car department of the Delaware, Lackawanna & Western at Scranton, Pa., has been appointed shop superintendent of the Keyser Valley shops. The position of general foreman has been abolished.

Walter Mersereau, car foreman of the Canadian National at Napadogan, N. B., has retired.

J. A. J. Arsenault has been appointed car foreman of the Canadian National at Napadogan, N. B.

Chicago, Milwaukee, St. Paul & Pacific.

The position of chief mechanical officer of the C.M.St.P.&P. at Milwaukee, Wis., held by F. K. Nystrom until his retirement on January 31, as noted in the February issue, has been abolished, and the following changes have become effective in the mechanical department at Milwaukee:

A. G. Hoppe, general superintendent locomotive and car department, has been appointed general superintendent locomotive department. The former position has been abolished.

A. V. Nystrom, assistant general superintendent locomotive and car department, has been appointed assistant to superintendent car department. The former position has been abolished.

V. L. Green, assistant mechanical engineer, has been appointed assistant superintendent car department.

J. A. Deppe and *F. A. Shoulty* continue as superintendent car department and assistant superintendent car department, respectively.

Electrical

William Henry Mims has been appointed electrical engineer of the Central of Georgia, with headquarters at Savannah, Ga. Mr. Mims is a graduate of Auburn Polytechnic Institute. He entered the service of the Central of Geor-

gia in 1944 and has served, successively as assistant shop engineer and shop engineer at Macon, Ga., and as assistant mechanical engineer and assistant general foreman at the Savannah shops.

Master Mechanics and Road Foremen

H. R. Martin has been appointed master mechanic of the New York Central with jurisdiction over the Indiana division and headquarters at Indianapolis, Ind.

C. M. Coffee has been appointed assistant master mechanic of the New York Central, with jurisdiction over the Indiana division and headquarters at Indianapolis, Ind.

P. J. McLean has been appointed assistant master mechanic of the Michigan Central (N.Y.C.) at St. Thomas, Ont.

W. C. Stancil, general foreman of the Atlantic Coast Line at Jacksonville, Fla., has been appointed master mechanic at Jacksonville.

E. D. Devaney has been appointed road foreman of engines of the Atlanta & West Point, the Western of Alabama, the Georgia Railroad, and Atlanta Joint Terminals, with headquarters at Augusta, Ga.

J. H. Zachry has been appointed road foreman of engines of the Atlanta & West Point, the Western of Alabama, Georgia Railroad, and Atlanta Joint Terminals, with headquarters at Montgomery, Ala.

H. L. Haggard, master mechanic of the New York Central, with jurisdiction over the Indiana division and headquarters at Indianapolis, Ind., has been transferred to the position of master mechanic at Matoon, Ill., with jurisdiction over the Illinois division.

A. S. Lingman has been appointed road foreman of engines of the Canadian National, with jurisdiction over the Hornepayne division and headquarters at Hornepayne, Ont.

R. J. Maher, acting assistant road foreman of engines, Eastern division of the Pennsylvania at Conway, Pa., has been appointed assistant road foreman of engines, Eastern division, with headquarters at Conway.

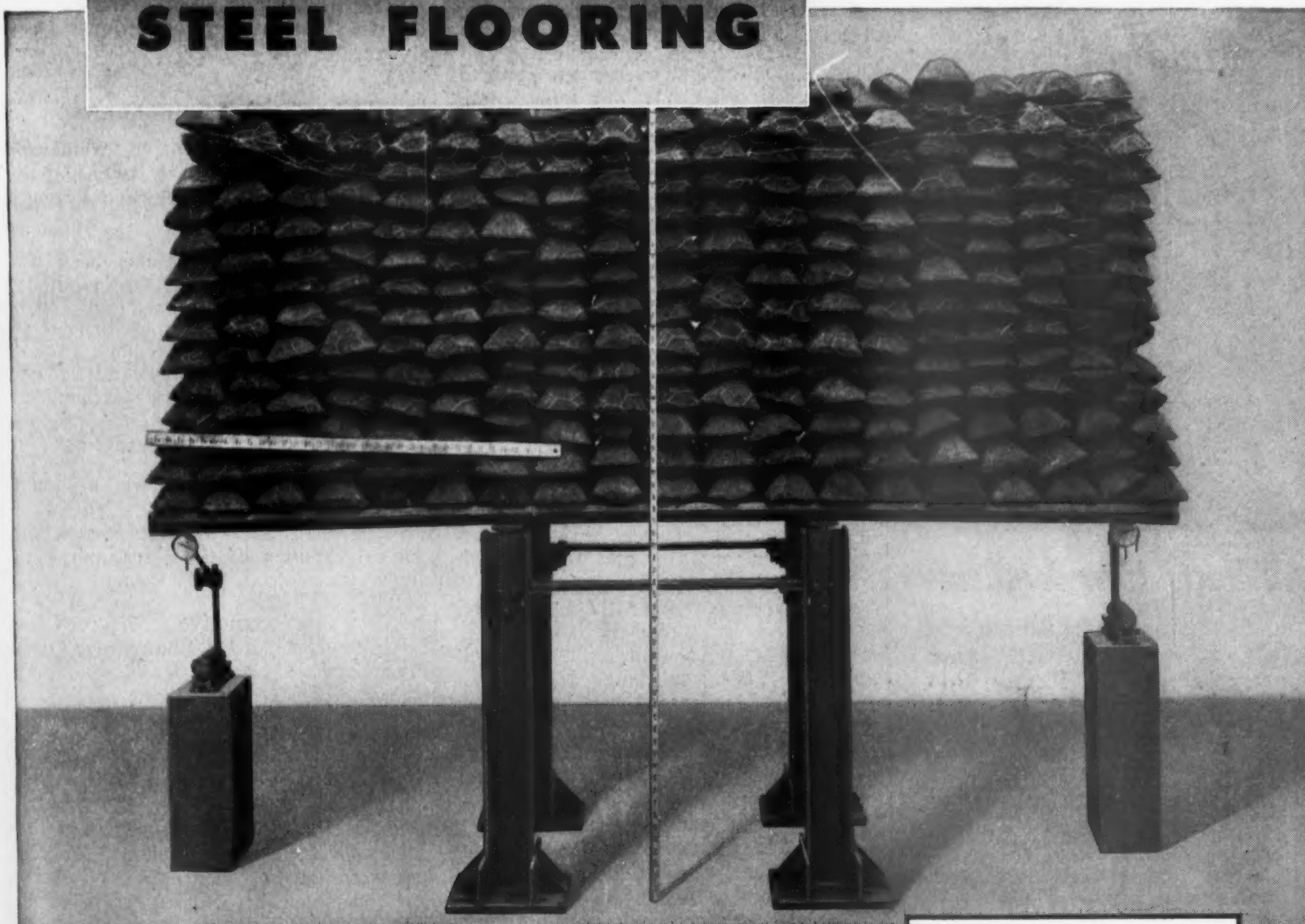
E. J. Jennings, acting road foreman of engines, Buffalo division, of the Pennsylvania at Buffalo, N.Y., has been appointed road foreman of engines, Buffalo division, with headquarters at Buffalo.

H. P. Ruck, car foreman, Indianapolis division of the Pennsylvania, has been appointed assistant master mechanic of the Pittsburgh-Conemaugh-Monongahela divisions, with headquarters at Pitcairn, Pa.

I. B. Scott, acting assistant road foreman of engines, Eastern division, of the Pennsylvania at Wellsville, Ohio, has

STOP DANGEROUS AND COSTLY BOXCAR FLOOR BREAK-THROUGH WITH NAILABLE STEEL FLOORING

In Detroit Testing Laboratory test to determine cantilever strength, 11,000 lbs. of pig iron were loaded on a panel consisting of three NAILABLE STEEL FLOORING boxcar channels welded side by side. The cantilever span was 30". Under this floor load of 733 pounds per square foot—far in excess of heaviest freight loading—the NAILABLE STEEL FLOORING section *hadn't even reached the yield point.*



In actual use as well as in laboratory tests it has been proved that NAILABLE STEEL FLOORING can't break through under *any* kind of heavy freight. Boxcars with NAILABLE STEEL FLOORING have safely hauled heavy copper cakes, automobile engines, highly concentrated loads of sheet steel and tinplate as well as hundreds of other commodities.

No Fork Truck Break-Throughs Either

NAILABLE STEEL FLOORING supports the biggest fork trucks, too, which so often break through conventional floors. For example, 23 cars are spotted each day at the Wabash Railroad's Ford Loading Dock in Detroit. Although they're all new or recently rebuilt, an average of *five* or *six* cars per day come in with large holes somewhere throughout the length of the floor where fork trucks have broken through.

Durability Means Low Maintenance . . . Low Operating Costs

NAILABLE STEEL FLOORING stops the break-throughs—and a good many other common floor troubles. It isn't chewed up by pinch bars or rough freight. Although nails are tightly clinched, they don't tear, splinter or deform the floor. All this adds up to lower maintenance costs—and lower operating costs as well. When floors stay in good condition for all types of freight, cars require less switching and empty movement.

To eliminate dangerous break-throughs and reduce maintenance costs, specify NAILABLE STEEL FLOORING for the next boxcars you build or rebuild.

"Many delays and potential accidents have occurred and are continuing to occur, due to pig iron, lead, copper bars and similar commodities breaking through boxcar floors . . . this condition . . . is due to the type of equipment selected for this type of loading." (Car Department Officers Association Report by Committee on Preparation of Freight Cars, September 20, 1948)

NAILABLE STEEL FLOORING
A GREAT LAKES STEEL PRODUCT

GREAT LAKES STEEL CORPORATION

Steel Floor Division • 3576 Penobscot Building • Detroit 26, Michigan

UNIT OF NATIONAL STEEL CORPORATION

been appointed assistant road foreman of engines, Eastern division, with headquarters at Wellsville.

L. H. Cooper, master mechanic of the Atlantic Coast Line at Jacksonville, Fla., has been appointed master mechanic at Rocky Mount, N. C.

H. R. Martin, assistant master mechanic of the New York Central at Mattoon, Ill., has been appointed master mechanic with headquarters at Indianapolis, Ind. The position assistant master mechanic at Mattoon has been abolished.

H. L. Haggard, master mechanic of the New York Central at Indianapolis, Ind., has been transferred to Mattoon, Ill.

E. J. Buckbee, master mechanic of the New York Central at Mattoon, Ill., has retired after 47 years of service.

Chicago, Milwaukee, St. Paul & Pacific.

The locomotive department of the C.M.St.P.&P. has been diviaded into four districts, to be known, respectively, as the Chicago, Milwaukee, Minneapolis (Minn.), and Tacoma (Wash.) districts. Personnel changes resulting from this move are as follows:

L. H. Rabun, division master mechanic at Savanna, Ill., has been appointed district master mechanic at Chicago, with jurisdiction over all locomotive department activities in the Chicago district.

L. H. Koch, assistant division master mechanic at Bensenville, Ill., has been appointed master mechanic at Chicago.

W. W. Henderson, division master mechanic at Marion, Iowa, has been appointed master mechanic at Savanna.

R. E. Magnuson, assistant division master mechanic at West Clinton, Ind., has been transferred to Bensenville.

B. L. Lebow, enginehouse foreman at West Clinton, has been appointed assistant master mechanic there.

C. G. Benkendorf, shop superintendent at Milwaukee, has been appointed district master mechanic at that point, with jurisdiction over all locomotive department matters in the Milwaukee district.

W. W. Bates, assistant superintendent of motive power (Diesel operation) at Milwaukee, has been appointed master mechanic there.

A. M. Hagen, assistant shop superintendent at Milwaukee, has been appointed also the master mechanic at Milwaukee.

H. S. Roe continues as master mechanic at Milwaukee, as does *W. J. Hughes* at Beloit, Wis.

J. L. Brossard, assistant superintendent of motive power at Milwaukee, has been appointed district master mechanic at Minneapolis, with jurisdiction over all locomotive department activities in the Minneapolis district.

M. A. Walsh continues as master mechanic at Miles City, Mont., as do *E. L. Grote* at Mason City, Iowa, and *R. C. Hempstead* at LaCrosse, Wis.

H. C. Pottsmith has been appointed master mechanic at Minneapolis.

Barry Glen, division master mechanic at Chicago, has been appointed district master mechanic at Tacoma, with jurisdiction over all locomotive department activities in the Tacoma district.

G. J. Johnston, division master mechanic at Spokane, Wash., has been appointed master mechanic at Tacoma.

H. W. Williams, division master mechanic at Tacoma, has been appointed assistant master mechanic there.

W. E. Brautigan continues as master mechanic at Deer Lodge, Mont.

A. W. Hallenburg has been appointed the assistant master mechanic at Deer Lodge.

Shop and Enginehouse

J. A. Roberge, locomotive foreman of the Canadian National at Parent, Que., has been appointed locomotive foreman at Chauvigny, Que.

Frederick J. Harris has been appointed general inspector, shop methods, of the Canadian National, with headquarters at Montreal, Que.

J. D. Kirouac, locomotive and car foreman of the Canadian National at Taschereau, Que., has been appointed locomotive foreman at Parent, Que.

John Wright McLeod, Jr., assistant mechanical engineer of the Central of Georgia, has been appointed assistant general foreman of the Savannah, Ga., shops.

J. Simard, locomotive foreman of the Canadian National at Chauvigny, Que., has retired.

J. A. T. Slater, assistant foreman of the Canadian National at Monk, Que., has been appointed locomotive foreman at Taschereau, Que.

A. M. Schuler, gang foreman at the Shire, Oaks, Pa., enginehouse of the Pennsylvania, has been appointed assistant foreman, Shire Oaks enginehouse, Monongahela division.

A. P. Stewart, general boiler foreman of the Canadian Pacific at Ogden, Alta., has been appointed assistant general boiler inspector, with headquarters at Calgary, Alta.

George A. Howard, general inspector, shop methods of the Canadian National at Montreal, Que., has been appointed mechanical engineer, shop methods, with headquarters at Montreal, Que.

F. J. Harris, designing draftsman of the Canadian National, has been appointed general inspector shop methods, with headquarters at Montreal, Que.

Obituary

Charles T. Ripley, who was chief mechanical engineer of the Atchison, Topeka & Santa Fe at Chicago until 1937, and who subsequently served as chief engineer of the Wrought Steel Wheel Industry in that city until his retirement in 1946, died at South Leguna, Calif., on February 6.